ANNUAL REPORT

OF THE

Calif. STATE BOARD OF HORTICULTURE

OF THE

STATE OF CALIFORNIA,

FOR 1890.

SACRAMENTO:
STATE OFFICE, : : : : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

STATE BOARD OF HORTICULTURE.

OFFICERS AND MEMBERS.

ELLWOOD COOPER, President........Santa Barbara,
Commissioner for the Los Angeles District.

L. W. BUCK, Vice-President........Vacaville,
Commissioner for the Napa District.

S. RUNYON, Treasurer........Courtland,
Commissioner for the Sacramento District.

J. L. MOSHER, Auditor........San Francisco,
Commissioner for the State at Large.

FRANK A. KIMBALL........National City,
Commissioner for the State at Large.

A. F. WHITE........Santa Rosa,
Commissioner for the Sonoma District.

FRED. C. MILES........Penryn,
Commissioner for the El Dorado District.

I. H. THOMAS........Visalia,
Commissioner for the San Joaquin District.

A. BLOCK........Santa Clara,
Commissioner for the San Francisco District.

EXECUTIVE COMMITTEE.

J. L. MOSHER, Chairman.

ELLWOOD COOPER. FRANK A. KIMBALL.

B. M. LELONG, Secretary........Ex officio Horticultural Officer.
ALEXANDER CRAW*........Clerk of the Publishing and Quarantine Bureau.
Miss ELLA F. HALLAHAN........Clerk.
HARRY STANLEY........Messenger.

Office of the Board:

No. 220 Sutter Street, San Francisco.

* Appointed; vice, Geo. Rice, resigned July 1, 1890.

CONTENTS.

	Page.
REPORT OF SECRETARY	10-22
SUPPLEMENTARY	183
REPORT OF TREASURER	16
REPORT OF THIRTEENTH FRUIT GROWERS CONVENTION	36
REPORT OF COUNTY HORTICULTURAL COMMISSIONERS	478-495
REPORT OF PROCEEDINGS OF BOARD	15
SPECIAL REPORTS	337-347
INDEX	515

ERRATA.

Page 288, 24th line, 12th word, for " botton " read " button."
Page 258, figure 29, read Philampel(u)s pandorus.
Page 286, figure 10, read "M(e)gilla vittigera."
Page 287, line 8 from below, for He(r)merobi(i)näe" read " Hemerobinäe.
Page 288, lines 7 and 8 from below, for " He(r)merobius" read " Hemerobius."
Page 27, line 30, read Mr. Muscott's address "San Bernardino" instead of "Santa Barbara."
Page 54, line 22, for " stretcher" read "stretch."
Page 64, line 17, for " T. E." read " D. E."
Page 257, figure 28, and figure 28½ on p ge 258, read "Macrosila celeus (quinquemaculata)" instead of " Macrosila carolina."

☞ *For further corrections see page 522.*

PREFATORY.

We desire to make fullest acknowledgment to all writers and officials of whose reports and standard works we have availed ourselves, and freely consulted, in the preparation of the Annual Report for 1889, and in the present volume. Among them we desire especially to mention the following:

"California Botany" (Geological Survey), by State Geologist J. D. Whitney, Vols. I and 11.

"Polypetalæ," by W. H. Brewer and Sereno Watson.

"Gamopetalæ," by Asa Gray—a book of special value to botanists.

"Downing's Fruit and Fruit Trees of America," by A. J. Downing.

"Fruit Trees" (from the French), by M. Du Baeuil.

"Barry's Fruit Garden," by P. Barry.

"California Fruits and How to Grow Them," by E. J. Wickson.

"Guide to the Study of Insects," by A. S. Packard, Jr., M.D.—a book which all fruit growers should have.

"The Insect World," by Louis Figuirer.

"Insects Injurious to Vegetation," by Thaddeus William Harris, M.D.

"Manual of Injurious Insects," by Miss Eleanor A. Ormerod.

"An Account of New Zealand Insects," by W. M. Maskell.

"Injurious Insects of the Orchard," by Matthew Cooke.

"Insects Injurious to Fruit," by William Saunders.

"An Introduction to Entomology," by J. Henry Comstock.

Report of J. A. Litner, State Entomologist, N. Y.

Report of C. M. Weed, State Entomologist, Ohio.

Report of Department of Agriculture, "Insect Life" (periodical bulletin), issued by the Division of Entomology, Washington, D. C.

"Foods: Their Composition and Analysis," by Alexander Wynter Blyth.

"The Techno-Chemical Receipt Book," by William T. Brannt.

"Agricultural Chemical Analysis," by Percy Faraday Frankland.

"Commercial Organic Analysis," by Alfred H. Allen.

"Agriculture in Some of Its Relations with Chemistry," by F. H. Storer.

"Experimental Chemistry," founded on the work of Dr. Julius Adolph Stockhardt.

And others.

We would be glad to be informed of any error or omission that unintentionally we may have made.

REPORT.

Office State Board of Horticulture,
San Francisco, December 30, 1890.

To his Excellency R. W. Waterman, *Governor, and to the Senate and Assembly of the State of California:*

In accordance with the amended law (Statutes 1889, Section 9, page 91), we most respectfully submit for your kind consideration this our annual report for the year 1890.

We desire to extend to your Excellency, and to all the various State Departments at Sacramento, our sincere thanks for your, and their, very kind assistance and counsel.

Respectfully submitted.

ELLWOOD COOPER,
President.

B. M. Lelong,
Secretary.

LAWS RELATING TO HORTICULTURE.

AN ACT

To create and establish a State Board of Horticulture.

[Approved March 13, 1883; amended by an Act approved March 8, 1889.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. There shall be a State Board of Horticulture, consisting of nine members, who shall be appointed by the Governor; two from the State at large, and one from each of the seven horticultural districts, which are hereby constituted as follows:

First—The Sonoma District, which shall include the Counties of Sonoma, Marin, Lake, Mendocino, Humboldt, Del Norte, Trinity, and Siskiyou.

Second—The Napa District, which shall include the Counties of Napa, Solano, and Contra Costa.

Third—The San Francisco District, which shall include the City and County of San Francisco, and the Counties of San Mateo, Alameda, Santa Clara, Santa Cruz, San Benito, and Monterey.

Fourth—The Los Angeles District, which shall include the Counties of Los Angeles, Ventura, Santa Barbara, San Luis Obispo, San Bernardino, and San Diego.

Fifth—The Sacramento District, which shall include the Counties of Sacramento, Yolo, Sutter, Colusa, Butte, Tehama, and Shasta.

Sixth—The San Joaquin District, which shall include the Counties of San Joaquin, Stanislaus, Merced, Fresno, Tulare, and Kern.

Seventh—The El Dorado District, which shall include the Counties of El Dorado, Amador, Calaveras, Tuolumne, Mariposa, Placer, Nevada, Yuba, Sierra, Plumas, Lassen, Modoc, Alpine, Mono, and Inyo.

SEC. 2. The members appointed from each district shall be residents of the district from which they are appointed, and shall be specially qualified by practical experience and study in connection with the industries dependent upon horticulture. They shall each hold office for the term of four years, except that of the nine first appointed, four, to be determined by lot, shall retire at the end of two years, when their successors shall be appointed by the Governor.

SEC. 3. [The Board shall biennially elect a President, a Vice-President, a Chairman of the Finance Committee, and appoint from without their own number a Secretary, who shall be ex officio Horticultural Officer, and elect of their own number a Treasurer, who shall give a bond to the State, with securities approved by the Board, in the sum of ten thousand dollars, for the faithful discharge of his duties.]

SEC. 4. The Board may receive, manage, use, and hold donations and bequests for promoting the objects of its formation. It shall meet semi-annually, and as much oftener and at such places as it may deem expedient, to consult and adopt such measures as may best promote the horticultural industries of the State. It may, but without expense to the State, select and appoint competent and qualified persons to lecture in each of the horticultural districts named in section one of this Act, for the purpose of illustrating practical horticultural topics, and imparting instruction in the methods of culture, pruning, fertilizing, and also in the best methods of treating the diseases of fruit and fruit trees, cleansing orchards, and exterminating insect pests. The office of the Board shall be kept open to the public, subject to the rules of the Board, every day, excepting legal holidays, and shall be in charge of the Secretary during the absence of the Board.

SEC. 5. For the purpose of preventing the spread of contagious disease among fruit and fruit trees, and for the prevention, treatment, cure, and extirpation of fruit pests and the diseases of fruit and fruit trees, and for the disinfection of grafts, scions, orchard debris, empty fruit boxes and packages, and other suspected material or transportable articles dangerous to orchards, fruit, and fruit trees, said Board shall make regulations for the inspection and disinfection thereof, which said regulations shall be circulated in printed form by the Board among the fruit growers and fruit dealers of the State, shall be published at least twenty days in two daily newspapers of general circulation in the State not of the same city or county, and shall be posted in three conspicuous places in each county in the State, one of which shall be at the County Court House thereof. Such regulations when so posted shall be held to impart notice of their contents to all persons within this State, and shall be binding upon all persons.

SEC. 6. [Said Board shall appoint without their number a competent person, especially qualified for the duties of his office, who shall be known as Clerk of the Publishing and Quarantine Bureau of the State Board of Horticulture (to hold office at the pleasure of the Board), who shall be qualified, by experience and education as a compiler, to cor-

NOTE.—The amendments to the various sections of the original Acts appear inclosed in brackets.

rect reports and essays; to present in a logical order all the information to be published, and shall give his whole time in such work, and such other duties as may be required of him by the Board and by reason of his official position, and shall have power to enforce all rules and regulations regarding the spread of insect pests, quarantining districts or nurseries found to be infected. He shall be paid for his services as Clerk of the Publishing and Quarantine Bureau of the State Board of Horticulture, one hundred and seventy-five dollars per month, to be paid as other State officers.]

SEC. 7. [The said Board, and in case of necessity during the recess of the Board, the said Clerk of the Publishing and Quarantine Bureau, may appoint such Quarantine Guardians as may be needed to carry out the provisions of this Act, whose duties it shall be to see that the regulations of the Board, and the instructions of the Clerk of the Publishing and Quarantine Bureau, are enforced and carried out; said Clerk may appoint, in case of emergency, a deputy, who shall have the same power as his own, whose salary shall not exceed three dollars per day for each day's services performed, said services to be paid by the State Board of Horticulture. The said Quarantine Guardians shall report to the said Clerk, or to the State Board, all infractions or violations of said directions, regulations, and of the law in regard to quarantine, disinfection, and destruction of insect and other pests injurious to fruit, fruit trees, or vines, and precautions against the spreading of all the aforesaid named pests and diseases. The salary of Quarantine Guardian shall not exceed three dollars per day, and shall be paid by the owners of orchards and other places and localities under quarantine regulations; and they may maintain an action therefor before any Justice of the Peace in any township in which any quarantined locality is wholly or in part situated, but in no case shall they have any claim upon the State for such services.]

SEC. 8. [It shall be the duty of the Secretary to attend all meetings of the Board and of the Executive Committee, and to preserve records of its proceedings and correspondence; to collect books, pamphlets, and periodicals, and other documents containing information relating to horticulture, and to preserve the same; to collect statistics and other information showing the actual condition and progress of horticulture in this State and elsewhere; to correspond with agricultural and horticultural societies, colleges, and schools of agriculture and horticulture, and other persons and bodies, as he may be directed by the Board; and prepare, as required by the Board, reports for publication. He shall appoint, subject to the approval of the Board, a competent person as clerk, and he shall be held responsible for the acts of said clerk. He shall be paid for his services as such Secretary and ex officio Horticultural Officer a salary of one hundred and seventy-five dollars per month. His clerk shall be paid a salary (as such clerk) of fifty dollars per month, each to be paid as other State officers.]

SEC. 9. [Repealed.]

SEC. 10. The Board shall, biennially, in the month of January, report to the Legislature a statement of its doings, with a copy of the Treasurer's accounts for the two years preceding the session thereof, and abstracts of the reports of the Inspector of Fruit Pests and Secretary.

SEC. 11. The Treasurer shall receive all moneys belonging to the Board, and pay out the same only for bills approved by it, and shall annually render a detailed account to the Board.

SEC. 12. There is hereby appropriated, for the use of the State Board of Horticulture, as set forth in this Act, out of any moneys in the State Treasury not otherwise appropriated, the sum of ten thousand dollars for the year commencing April first, one thousand eight hundred and eighty-five, and ten thousand dollars for the year commencing April first, one thousand eight hundred and eighty-six, and the State Controller will draw his warrants upon the State Treasurer in favor of the Treasurer of said Board for the said sums, or any part thereof, when they become available, upon proper demand being made for the same by the said Board. [There is hereby appropriated for the use of the State Board of Horticulture, as set forth in this Act, out of any moneys in the State Treasury not otherwise appropriated, for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, the sum of one thousand dollars, and the State Controller shall draw his warrants upon the State Treasurer in favor of the Treasurer of said Board for the same, upon proper demand.]

SEC. 13. This Act shall take effect and be in force from and after its passage, and all Acts or parts of Acts inconsistent or in conflict with the provisions of this Act are hereby repealed.

SEC. 14. [The President (and in his absence, the Vice-President) and the two Commissioners for the State at large, shall constitute the Executive Committee; said committee shall have charge of the management of the affairs of the Board while the Board is not in session. The members of said committee shall receive their actual traveling expenses in attending quarterly meetings of the Executive Committee. The other members of the Board shall receive their actual traveling expenses (only) in attending semi-annual meetings of the Board.]

SEC. 15. [Vacancies occurring in any office shall be filled by appointment made by the President of the Board, with the consent of the Executive Committee, until the next meeting of the Board.]

SEC. 16. [The Board shall make and publish their reports annually.]

SEC. 17. [It shall be the duty of the County Boards of Horticulture to make quarterly reports in writing to the State Board of the condition of fruit interests in their several districts, what is being done to eradicate insect pests, also as to disinfecting, and as to quarantine against new insects, and as to carrying out of all laws relative to the greatest

good of the fruit interest. Said Board shall publish said reports in bulletin form, or may incorporate so much of the same in their annual reports as may be of general interest.]

SEC. 18. [The expenditures necessary to be made in experiments in the different districts shall be determined by the Board. On application of one or more of the fruit growers in such districts, the said Board shall select such person or persons to make such experiments, and pay the expenses thereof. The sum of not exceeding one thousand dollars for traveling expenses shall be allowed when the Board or the Executive Committee shall deem it necessary to send either the Clerk of Bureau or Secretary to direct and supervise such experiments; *provided*, that not more than one thousand dollars shall be expended in any one year for such traveling expenses.]

AN ACT

To protect and promote the horticultural interests of the State.

[Approved March 14, 1881; amended by an Act approved March 19, 1889.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. Section one of said Act is hereby amended so as to read as follows:

Section 1. [Whenever a petition is presented to the Board of Supervisors of any county, and signed by twenty-five or more persons who are resident freeholders and possessors of an orchard, or both, stating that certain or all orchards or nurseries, or trees of any variety, are infested with scale insects of any kind, injurious to fruit, fruit trees, and vines, codlin moth, or other insects that are destructive to trees, and praying that a Commission be appointed by them, whose duty it shall be to supervise their destruction as herein provided, the Board of Supervisors shall, within twenty days thereafter, select three Commissioners for the county, to be known as a County Board of Horticultural Commissioners. The Board of Supervisors may fill any vacancy that may occur in said Commission by death, resignation, or otherwise, and appoint one Commissioner each year, one month, or thereabouts, previous to the expiration of the term of office of any member of said Commission. The said Commissioners shall serve for a period of three years from the date of their appointment, except the Commissioners first appointed, one of whom shall serve for one year, and one of whom shall serve for two years, and one of whom shall serve for three years, from the date of appointment. The Commissioners first appointed shall themselves decide, by lot or otherwise, who shall serve for one year, who shall serve two years, and who shall serve three years, and shall notify the Board of Supervisors of the result of their choice.]

SEC. 2. Section two of said Act is hereby amended so as to read as follows:

Section 2. [It shall be the duty of the County Board of Horticultural Commissioners in each county, whenever it shall deem it necessary, to cause an inspection to be made of any orchard, or nursery, or trees, or any fruit-packing house, store-room, sales-room, or any other place in their jurisdiction, and if found infested with scale bug, codlin moth, or other insect pests injurious to fruit, trees, and vines, they shall notify the owner or owners, or person or persons in charge or possession of said trees or place, as aforesaid, that the same are infected with said insects, or any of them, or their eggs or larva, and they shall require such person or persons to disinfect or destroy the same within a certain time, to be specified. If within such specified time such disinfection or destruction has not been accomplished, the said person or persons shall be required to make application of such treatment for the purpose of destroying them as said Commissioners may prescribe. Said notices may be served upon the person or persons owning or having charge or possession of such infested trees, or places, or articles, as aforesaid, by any Commissioner, or by any person deputed by the said Commissioners for that purpose, or they may be served in the same manner as a summons in a civil action. If the owner or owners, or the person or persons in charge or possession of any orchard, or nursery, or trees, or places, or articles, infested with said insects or any of them, or their larva or eggs, after having been notified as above to destroy the same, or make application of treatment as directed, shall fail, neglect, or refuse so to do, he or they shall be deemed guilty of maintaining a public nuisance, and any such orchards, nurseries, trees, or places, or articles thus infested, shall be adjudged and the same is hereby declared a public nuisance, and may be proceeded against as such. If found guilty, the Court shall direct the aforesaid County Board of Horticultural Commissioners to abate the nuisance. The expenses thus incurred may be a lien upon the real property of the defendant.]

SEC. 3. Section three of said Act is amended so as to read as follows:

Section 3. [Said County Boards of Horticultural Commissioners shall have power to divide the county into districts, and to appoint a local Inspector for each of said districts. The State Board of Horticulture, or the Quarantine Officer of said Board, shall issue commissions as Quarantine Guardians to the members of said County Boards of Horticultural Commissioners, and to the local Inspectors thereof. The said Quarantine Guardians, local Inspectors, or members of said County Boards of Horticultural Commissioners, shall have full authority to enter into any orchard, nursery, or place or places where trees or plants are kept and offered for sale, or otherwise, or any house, store-room, sales-room, depot, or any other such place in their jurisdiction, to inspect the same, or any part thereof.]

SEC. 4. Section four of said Act is hereby amended so as to read as follows:

Section 4. [It shall be the duty of said County Board of Horticultural Commissioners to keep a record of their official doings, and to make a report to the State Board of Horticulture, on or before the first day of October of each year, of the condition of the fruit interests in their several districts, what is being done to eradicate insect pests, also as to disinfecting, and as to quarantine against insect pests and diseases, and as to carrying out all laws relative to the greatest good of the fruit interest. Said Board shall publish said reports in bulletin form, or may incorporate so much of the same in their annual reports as may be of general interest.]

SEC. 5. Section five of said Act is hereby amended so as to read as follows:

Section 5. [Each member of the County Board of Horticultural Commissioners, and each local Inspector, shall be paid for each day actually engaged in the performance of his duties under this Act, payable out of the County Treasury of his county, such compensation as shall be determined by resolution of the Board of Supervisors of the county, before entering into the discharge of his or their duties.]

SEC. 6. Section six of said Act is hereby amended so as to read as follows:

Section 6. [Said County Boards of Horticultural Commissioners shall have power to remove any local Inspector who shall fail to perform the duties of his office.]

SEC. 7. [Repealed.]

SEC. 8. Section eight of said Act is hereby amended so as to read as follows, and to be known as section seven of said Act, viz.:

Section 7. [If any member of the County Board of Horticultural Commissioners shall fail to perform the duties of his office, as required by this Act, he may be removed from office by the Board of Supervisors, and the vacancy thus formed shall be filled by appointment by the Board of Supervisors.]

SEC. 9. Section nine of said Act is hereby amended so as to read as follows, and to be known as section eight of said Act, viz.:

Section 8. [It shall be the duty of the County Board of Horticultural Commissioners to keep a record of their official doings, and to make a monthly report to the Board of Supervisors, and the Board of Supervisors may withhold warrant for salary of said members and Inspectors thereof until such time as said report is made.]

SEC. 10. A new section is hereby added to said Act, to be known as section nine, and to read as follows, viz.:

Section 9. All Acts or parts of Acts in conflict with the provisions of this Act are hereby repealed.

SEC. 11. This Act shall take effect and be in force from and after its passage.

CONSTITUTIONALITY OF ACTS.

OPINION OF THE ATTORNEY-GENERAL.

OFFICE OF THE ATTORNEY-GENERAL OF THE STATE OF CALIFORNIA,
SACRAMENTO, June 10, 1889.

B. M. LELONG, *Esq., Secretary State Board of Horticulture, San Francisco:*

DEAR SIR: Replying to your inquiry of eighth instant, I have to say that I regard the Act "to amend an Act entitled 'An Act to protect and promote the horticultural interests of the State,'" approved March 14, 1881, Statutes of 1889, page 413, constitutional. It is a later Act than the other Act to which you call my attention, approved March 7, 1889, Statutes of 1889, page 89, and if there is any conflict between the two Acts, the later Act must prevail, but I do not wish to be understood as saying that there is any conflict.

I think the Board of Supervisors of Sonoma County, on the presentation of a proper petition, as required by the Act of March 19, 1889, should, within the time limited, select a County Board of Horticultural Commissioners. Nor is it necessary for me at this time to give an opinion whether everything in the Act of March 19, 1889, is constitutional.

Very truly yours,

G. A. JOHNSON,
Attorney-General.

SUPERIOR COURT DECISION.

APPOINTMENT OF COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS MANDATORY.

Hon. Jno. G. Pressley, Judge of the Superior Court of Sonoma County, on the nineteenth of June, 1889, rendered the following decision, in which the validity of the Act, directing the Boards of Supervisors to establish County Boards of Horticultural Commissioners, is sustained:

E. A. Rogers vs. the Board of Supervisors of Sonoma County.

John Goss, Esq., attorney for plaintiff.

On the nineteenth of March an Act of the Legislature was approved entitled "An Act to amend an Act entitled 'An Act to protect and promote horticultural interests of the State,' approved March 14, 1881."

This Act (of March, 1889) provides that, "Whenever a petition is presented to the Board of Supervisors of any county, and signed by twenty-five or more persons who are resident freeholders and possessors of an orchard, or both, stating that certain or all orchards, or nurseries, or trees of any variety, are infested with scale insects that are destructive to trees, and praying that a Commission be appointed by them, whose duty it shall be to supervise their destruction as herein provided, the Board of Supervisors shall, within twenty days thereafter, select three Commissioners for the county, to be known as a County Board of Horticultural Commissioners."

The duties of the Board so appointed are declared by the Act. It appears from the complaint that in accordance with this Act, a petition was presented to and filed with the Board of Supervisors, signed by this plaintiff and twenty-six other persons possessing the qualifications prescribed by the Act, praying for the appointment of a County Board of Horticultural Commissioners for Sonoma County, and a demand was made on the Supervisors that they carry into effect the provisions of the Act and appoint the Commissioners.

The Board refused to appoint Commissioners.

Twenty days have expired since the filing of the petition and the demand for action upon it, and still the Board of Supervisors refuse and neglect to make any selections or appointment of Commissioners.

This action is brought for a writ of mandate compelling the Board of Supervisors to make the selection and appointment as required of them by the Act.

A demurrer has been interposed to the complaint, and in support thereof, it is contended:

First—That the Act of fourteenth of March, 1881, of which the Act of nineteenth of March is amendatory, was repealed by an Act approved thirteenth of March, 1883, which provides for the appointment by the Governor of a State Board of Horticulture, and that in consequence of the Act of 1889 being amendatory of a repealed statute it is nugatory.

The Act of 1883 does not, in express terms, repeal the Act of 1881, nor is that Act elsewhere expressly repealed. It is a well settled legal principle that repeals by implication are not favored. A subsequent Act does not, by implication, repeal a prior statute unless the subsequent one entirely covers the provisions of the first, and so completely that every portion of the first is provided for by the second. There must appear an intent to entirely substitute one for the other.

Says Bishop in his work on Statutory Crimes, Section 154: "We have seen that every legislative Act in affirmative words is to be regarded, *prima facie*, as an addition to the mass of the law; for such on its face it purports to be. Yet, when it is inconsistent with the former law, it must, as the last expression of the legislative will, prevail. But repeals by implication, thus explained, are not favored. And a legislative intent to repeal an existing statute is not presumed. If two Acts, seeming to be repugnant, can be reconciled by any fair construction, they must be, when no repeal will be held to take place."

The same principle is laid down by Judge Field in the case of *Pierrepont* vs. *Crouch*, 10 Cal. 316.

There are numerous other authorities to the same effect.

Is there any apparent intent to substitute one of these Acts for the other, or such repugnance as would destroy the first? Let us see. The first provides for a County Board of Horticulture. The second for a State Board. The first prescribes duties to be performed by County Boards of Supervisors. The second prescribes duties to be discharged by the Governor. The first provides for a Board of three Commissioners with local jurisdiction. The second for a Board of nine Commissioners with a jurisdiction coextensive with the State. The first authorizes Boards created by its authority to divide counties into districts. The second creates districts composed of several counties. The first requires duties to be performed by County Boards which are not required by the second of the State Board. For instance: The first provides for proceedings against persons who, after notice, fail or refuse to treat infested trees as directed by the Board, and a destruction of trees by such Board when directed by a Court. No such proceedings and destruction are provided for by the second. There are other differences between the two Acts which might be pointed out, but these are sufficient to show that there is no such similarity in the powers of the Boards created by them as would necessarily cause a conflict between these Boards, or would justify a Court in holding that one Act repeals the other. I must, therefore, hold that the Act of 1881 was not repealed by the Act of 1883, and was in full force when the amendatory Act of 1889 was passed. The Act of 1883 is an addition to the then existing legislation, and not a substitute for the Act of 1881.

Second—It was contended that Acts of the Legislature which provided that a duty imposed shall be performed within a certain time are directory and not mandatory. I cannot assent to that proposition. Where a Court or Board is directed by law to perform an act in a given time, the law, unless it declares the act may not be done after the expiration of the time, is so far directory as that the act is valid, though done after the time fixed, but is not directory in the sense that the duty or act directed may be entirely disregarded or omitted. The time is given that the Board may have ample opportunity to act intelligently and with good judgment, but not to enable the Board or officer of whom the duty is required to disregard it entirely. I have no doubt but that the Board of Supervisors is required by the law in question to appoint a County Board of Horticultural Commissioners, and that it may be lawfully done after the expiration of the twenty days given them in the Act for deliberation.

Counsel referred to some authorities from other States in support of his contention. I

do not think these authorities go to the extent claimed by him, and if they did, there being not such decision by our own Supreme Court, I would hold the law in this State to be different. The purpose of the Legislature was to give the Supervisors time to make judicious selections, and not to justify or authorize an annulment of the legislative will expressed by the statute.

REGULATIONS

TO PREVENT THE SPREAD OF CONTAGIOUS DISEASES AMONG FRUIT AND FRUIT TREES; AND FOR THE PREVENTION, TREATMENT, CURE, AND EXTIRPATION OF FRUIT PESTS AND DISEASES OF FRUIT AND FRUIT TREES; AND FOR THE DISINFECTION OF GRAFTS, SCIONS, ORCHARD DEBRIS, EMPTY FRUIT BOXES, ETC.

[Adopted by the State Board of Horticulture at the meeting of June 29, 1889.]

All purchasers who have received fruit in any box, sack, or other package of any description, shall immediately upon receiving the same disinfect each box, sack, or other package, by subjecting it to boiling water or steam under pressure for a sufficient length of time to destroy all insects or germs attached to or contained in such box, sack, or other package; and all such boxes, sacks, and other packages shall be kept secure from infection so long as they remain in the place where disinfected.

Disinfection of Fruit Trees, Scions, etc.

For the purpose of disinfecting fruit trees, scions, cuttings, grafts, etc., the following is recommended:

Whale-oil soap (80 per cent strength)	5 pounds.
Water	4 gallons.

Directions.—Dissolve thoroughly soap in water, and immerse the tree, scion, cutting, or plant for at least two minutes, while the solution is still hot, or for such length of time as will destroy all insects or germs.

Pernicious (Aspidiotus Perniciosus) Scale.

Summer Remedy for Peaches.

Potash	14 pounds.
Caustic soda (98 per cent)	8 pounds.
Lime, unslacked	5 pounds.
Fish oil, polar or seal	10 gallons.

Directions.—First—Dissolve the soda and potash by placing them together in about ten or twelve gallons of water.

Second—Slack the lime in the barrel in two gallons of water; then add the fish oil to the lime and stir well until the lime and the oil have turned to a thick batter; then add the soda and potash, water, boiling hot, and stir well with a dasher for five minutes or more. Then leave standing for about four or six hours; then fill up with cold water; do not pour in all the water at once, but about two buckets at a time. Stir well as the first two buckets of water go in, to prevent lumps. Use the following day. Apply cold, one pound to the gallon of water. In dissolving it do not boil, but weigh the amount to be used, place in a barrel, and on top of it pour hot water, about one bucket to every one hundred pounds of material.

After pouring in the hot water, stir lively with a dasher until it is entirely dissolved; then reduce with cold water until thin enough to pass through the strainer; then place in the tank and fill up with water; stir well and it is ready for use; apply cold.

Summer Remedy for Pears and Apples.

Caustic soda (98 per cent)	10 pounds.
Potash	10 pounds.
Tallow	40 pounds.
Resin	40 pounds.

Directions.—First—Dissolve the potash and soda in ten gallons of water. When dissolved, place the whole amount in the barrel (fifty-gallon measure).

Second—Dissolve the tallow and resin together. When dissolved, add the same to the potash and soda in the barrel, and stir well for five minutes or so. Leave standing for about two hours; then fill up with water, stirring well as every bucket of water goes in. Use the following day, one pound to the gallon of water; apply warm.

Winter Remedy.

Lime	25 pounds.
Sulphur	20 pounds.
Salt	15 pounds.

Directions.—Take ten pounds of lime, twenty pounds of sulphur, and twenty gallons of water; boil until the sulphur is thoroughly dissolved. Take the remaining fifteen pounds of lime and fifteen pounds of salt, and when thoroughly slacked, mix together and add enough water to make in all sixty gallons of solution; strain, and apply warm.

Brown Apricot Scale.

Summer Remedy.

Caustic soda (98 per cent)	1 pound.
Resin	5 pounds.
Water	40 gallons.

Directions.—Boil caustic soda in one and one half gallons of water. When dissolved, take out and lay aside one half of the solution; then add resin to the remainder in the kettle. After resin is dissolved, add slowly balance of soda solution. When thoroughly cooked, add water to make in all forty gallons of solution; apply warm.

Winter Remedy.

Sulphur	20 pounds.
Lime	25 pounds.
Salt	15 pounds.

Directions.—Take ten pounds of the lime, twenty pounds of the sulphur, and twenty gallons of water. Boil until the sulphur is thoroughly dissolved. Take the remainder—fifteen pounds of lime and fifteen pounds of salt—slack, and add water to make the whole mixture sixty gallons. Mix the whole together, strain, and spray on the trees milk warm or warmer. This can only be applied when the foliage is off the tree, and has in this condition no injurious effect on the fruit buds or tree whatever.

For Cottony Cushion (Icerya Purchasi) Scale.

Caustic soda (98 per cent)	2 pounds.
Resin	10 pounds.

Directions.—Boil caustic soda in one and one half gallons of water. When dissolved, take out and lay aside one half of the solution; then add resin to the remainder in the kettle. After resin is dissolved, add slowly balance of soda solution. When thoroughly cooked, add water enough to make in all forty gallons of solution; apply warm.

For Black Scale (Lecanium Olea) on Olive Trees.

Five gallons best kerosene oil, 150 degrees test; one and one fourth pounds good common soap, or one bar and a half of soap usually sold as pound packages; two and a half gallons of water. This makes the emulsion. When using, dilute six and one half gallons of water for each gallon of oil, and to this mixture add two and a half pounds of good home-made soap dissolved in boiling water. All this mixing should be done with hot water, and applied at a temperature of 140 degrees Fahrenheit.

Red Scale (Aspidiotus Aurantii) on Citrus Trees.

Caustic soda (98 per cent)	8 pounds.
Resin	15 pounds.
Whale oil or fish oil	2 quarts.

Directions.—Boil oil, caustic soda, and resin together in about ten gallons of water for about three or four hours; then add water enough to make in all one hundred gallons of solution. Apply warm. Must be cooked well as per directions, to secure best results.

For Codlin (Carpocapsa Pomonella) Moth.

For Early Ripening Apples and Pears.

Spray once with one pound of Paris green to one hundred and eighty gallons of water, when just out of bloom.

For Fall and Winter Apples and Pears.

Spray twice. First application as above; second application with one pound of Paris green to two hundred gallons of water. Use the Paris green without any additions, simply stirring the liquid continually and straining it before using.

For Woolly (Schizoneura Lanigera) Aphis.

Root Form.—Dress liberally with ashes, especially in moist localities, or use gas lime, about one and one half shovelfuls around each tree in such a manner that it will not come in direct contact with the bark of the tree.

Branch Form.—Brush with kerosene emulsion, or resin solution, or spray.

For Flowering Shrubs or Garden Plants.

Sulphur	1 pound.
Lime	1 pound.
Water	2 gallons.

Directions.—Boil ingredients together one hour. Dilute one gallon of the mixture with three gallons of water; use more or less water according to the strength of the plant.

Borers.

Guard trees from infection by placing a shake or board on the south and west sides of the tree, which protects it from sunburn; or give a coating of whitewash, containing some soap and sulphur. In removing a borer, smear the wound over with grafting wax.

Peach Root (Sannania Pacifica) Borer.

Remove the earth at the base of the tree and wrap up the trunk with stout paraffine paper, and pile up against the paper air-slacked lime or ashes.

Note.—Wherever beneficial insects or parasites are decreasing the spread of injurious insect pests, no spray or wash should be used, and the parasites should be colonized and taken care of.

EXTRACTS FROM MEETINGS OF THE BOARD.

March 10, 1890.

The Board met in Los Angeles pursuant to a resolution adopted at the meeting held in Fresno November 8, 1890. The following Commissioners were present: Messrs. Block, Buck, Kimball, Miles, Mosher, Runyon, Thomas, and President Cooper. Absent, Commissioner White.

The minutes of November 4–8, 1889, were read and duly approved.

The President announced that Rev. N. R. Peck had resigned as Commissioner, and that the Governor had appointed Mr. Fred. C. Miles, of Penryn, and welcomed Mr. Miles into the Board.

Nominations for the position of Vice-President, made vacant by the resignation of Commissioner Peck, were then declared in order.

Commissioner Block nominated Commissioner Buck for the position of Vice-President.

On motion, nominations were closed, and the Secretary was directed to cast the vote of the Commissioners present for Mr. Buck.

The Secretary cast the vote of the Commissioners present for Commissioner L. W. Buck, for the position of Vice-President, and he was declared unanimously elected by President Cooper.

Vice-President Buck made a few remarks, in which he returned warm thanks for the honor conferred, and promised to perform the duties of the office to the best of his ability.

SECRETARY'S REPORT.

The report of the Secretary was read, covering the period since the last meeting of the Board, as follows:

To the honorable the State Board of Horticulture:

Gentlemen: I herewith submit to your kind consideration this, my report as your Secretary, since your last meeting held at Fresno, November 4, 1889.

PUBLICATIONS.

In accordance with a resolution adopted at your last meeting there were twenty thousand bulletins, No. 53, reprinted. The annual report for 1889 has just been issued. It is a volume of nearly six hundred pages, contains nearly three hundred illustrations, and four lithographic plates.

MEMORIALS.

In accordance with the wishes expressed at the last meeting, and at the last Convention, I have forwarded to Congress all such memorials as have been adopted at these meetings. Replies have been received from our representatives that they would receive their due consideration.

QUARANTINE GUARDIANS.

Since my last report the following have been commissioned Quarantine Guardians: John M. Balhache, E. A. Rogers, Mark L. McDonald, J. R. Totman, Frank W. Willis, F. M. Johnson, W. J. Clarke, Thomas Knoch, C. F. Ayer, J. B. Wilkie, F. F. Clyma, F. Edw. Gray, W. O. Welch, Thomas Weiss, W. G. Jasper, Hiram Hamilton, G. W. Preble, F. H. Keith, J. H. Thomas, R. P. Patterson, E. W. Meglone, L. D. Coffee, A. C. Koch, F. W. Rohlfing, Ed. Harkness, C. J. Berry, G. M. Gray.

EXECUTIVE COMMITTEE.

The Executive Committee met at the office on February 24 and 25, 1890, in pursuance of instructions from you, to take an inventory of all State property in our charge; they, no doubt, will present a report.

VICE-PRESIDENT.

By reason of a vacancy in the office of Vice-President of the Board, caused by the resignation of Rev. N. R. Peck, as Commissioner, having moved out of his district, the President, who is authorized by law to fill all vacancies, with the advice and consent of the Executive Committee, appointed Commissioner L. W. Buck to that office.

DEATHS.

It becomes my painful duty to officially announce the demise of Gen. M. G. Vallejo, your former Treasurer and Commissioner for the Sonoma District. He died at his residence in Sonoma, on the eighteenth day of last January, after a painful and lingering illness.

The late General was too well known for me to offer at this time words in eulogy to his memory, but believe that President Cooper voiced the sentiments of the Board in saying: "He was one of Nature's noblemen—a generous heart, a soul beaming with kindness, simple as a child, and true in every instinct. A great man has gone."

I most respectfully recommend that when this Board does adjourn, it do so out of respect to the late General M. G. Vallejo.

Respectfully submitted.

B. M. LELONG,
Secretary.

SAN FRANCISCO, CAL., March 1, 1890.

The report was received and placed on file, on motion of Commissioner Block.

The appointments of Quarantine Guardians made since the last meeting of the Board were, on motion of Commissioner Block, confirmed.

TREASURER'S REPORT.

The Treasurer then presented his report as follows:

To the honorable the State Board of Horticulture:

GENTLEMEN: I herewith submit to your consideration this, my report as your Treasurer, up to March 1, 1890.

The following are the amounts paid in warrants to cover claims, as follows, viz.:

October 10, 1889—Call Co., "Call," one year	$7 80	
Dutton & Patridge, supplies	5 95	
A. W. Rose, rent	135 00	
G. G. Wickson & Co., supplies	22 50	
Samuel Carson & Co., books	6 70	
N. W. Motheral, salary and traveling expenses (Special Agent)	212 45	
L. A. Bertling & Co., supplies	15 50	
J. R. Dobbins, salary (Special Agent)	75 00	
W. B. Dunlap, books	9 50	
J. Caire, chemicals, etc.	12 00	
B. M. Lelong, traveling expenses	135 75	
Archul & Co., fruit jars (stone, one dozen)	7 20	
G. G. Wickson & Co., typewriter paper	5 50	
Wells, Fargo & Co., expressage	12 55	
M. Denicke, fruit for experimental purposes	15 00	
J. W. DeLamater, fruit for experimental purposes	7 50	
W. J. Bryan, Postmaster, stamps	154 00	
Cartage	27 90	
Freight	16 25	
Janitor	10 50	
Office boy	9 00	
Telegrams	3 70	
Subscriptions to papers, "Garden and Florist," "Journal of Horticulture," "The Garden"	11 85	
Supplies	16 10	
		$935 20
November 2, 1889—Dutton & Partridge, supplies	$10 85	
H. S. Crocker & Co.	30 00	
Justinian Caire, chemicals	4 75	
Chris. Jorgensen, water color sketching	50 00	
A. W. Rose, rent	135 00	

J. R. Dobbins, salary (Special Agent)	$39 00	
W. L. Bovyer, carpenter work	43 00	
John T. Gray, plumbing	3 00	
T. W. Jackson & Co., caustics	4 00	
P. W. Butler, olives for experimental purposes	9 00	
A. H. Ste Marie, translating	66 75	
A. Scherchy, translating	20 00	
Alschul & Co., fruit jars, (two dozen)	14 40	
Wempe Bros., paper boxes	3 00	
A. D. Oakley & Co., stencils, etc.	6 00	
Cartage	16 05	
Wells, Fargo & Co., expressage	7 90	
Freight	16 97	
Telegram	40	
Gas	1 60	
Office boy	12 00	
Janitor	4 00	
Supplies	5 75	
		$503 42
November 27, 1889—Dutton & Partridge, supplies	$2 00	
Dewey & Co., books	5 25	
Chris. Jorgensen, sketching	55 15	
N. W. Motheral, salary and traveling expenses	203 90	
Geo. Rice, traveling expenses	11 20	
I. H. Thomas, traveling expenses	20 35	
N. R. Peck, traveling expenses	29 35	
J. L. Mosher, traveling expenses	45 70	
Ellwood Cooper, traveling expenses	50 80	
A. Block, traveling expenses	30 25	
A. W. Rose, rent	135 00	
A. K. Whitton, reporting	250 00	
B. M. Lelong, traveling expenses	27 90	
M. S. Flynn, one week's work	15 00	
J. R. Dobbins, three days' service, with team	15 00	
J. R. Winterburn & Co., cuts	75	
Miss M. E. Wilson, woodcuts	34 00	
Freight	5 48	
Cartage	4 65	
Expressage	14 50	
Office boy, three weeks	9 00	
Gas	3 00	
Supplies	90	
		$969 13
December 14, 1889—"Overland Monthly," one year	$4 00	
Dutton & Partridge, supplies	5 50	
The J. Dewing Co.	5 00	
Chris. Jorgensen, sketching	5 00	
A. W. Rose, rent	135 00	
L. W. Buck, traveling expenses	46 60	
Sol. Runyon, traveling expenses	42 40	
Samuel Carson & Co., books	56 00	
Miss M. E. Wilson, wood engravings	50 00	
J. R. Winterburn & Co., electro cuts	19 00	
E. C. French, wood engravings	26 00	
Alschul & Co., fruit jars	3 50	
Cartage	1 00	
Wells, Fargo & Co., expressage	7 75	
Janitor, two months	21 35	
Office boy, three weeks	9 00	
Supplies	1 30	
		$438 40
January 6, 1890—Dutton & Partridge, supplies	$1 25	
A. M. Ebbetts, coal	5 75	
Samuel C. Partridge, supplies	16 85	
A. W. Rose, rent	135 00	
Photo-Engraving Co., photo-electric cuts	34 00	
Miss Bertha Henicke, wood engravings	39 00	
J. R. Winterburn & Co., electro cuts	14 00	
Wells, Fargo & Co., expressage	20 45	
Telegrams	1 50	
Cartage	3 45	
Office boy, three weeks	9 00	
Janitor	10 50	
		$290 75
January 25, 1890—Dutton & Partridge, supplies	$26 60	
California Furniture Co., supplies	30 00	

P. J. Healey, books	$5 50	
C. C. Reidy, wood cuts	10 00	
Dewing & Co., paper, one year	3 00	
Geo. Rice, traveling expenses	17 50	
B. M. Lelong, traveling expenses	35 00	
W. J. Bryan, Postmaster, stamps	85 00	
J. R. Winterburn & Co., electro cuts	2 00	
Wells, Fargo & Co., expressage	31 05	
Cartage	3 25	
Telegrams	3 45	
Supplies	1 20	
Office boy, three weeks	9 00	
Janitor	10 50	
		$273 05
Chris. Jorgensen, sketching	$2 00	
Jas. Duffy & Co., supplies	1 50	
Swan, Stein & Co., supplies	4 00	
Union Box Factory, supplies	45 72	
P. J. Healy, books	7 50	
G. G. Wickson & Co., supplies	2 50	
California Furniture Co., supplies	26 00	
Dutton & Partridge, supplies	33 00	
A. W. Rose, rent	135 00	
J. R. Winterburn & Co., electro cuts	6 10	
Wells, Fargo & Co., expressage	8 75	
Swasey & Co., printing fruit plates	5 50	
Gas	9 60	
Office boy, two weeks	6 00	
Supplies	11 80	
		$304 97

Total	$3,714 92
Amount expended up to last meeting	6,569 61
Appropriation	$12,500 00
Balance in Treasury	$2,215 47

Salary Fund.

Salary Secretary, eight months	$1,400 00
Salary Clerk of P. & Q. B., eight months	1,400 00
Salary Secretary's Clerk, eight months	400 00
Total	$3,200 00
Appropriation	4,800 00
Balance	$1,600 00

Very respectfully submitted.

SOL. RUNYON,
Treasurer.

SAN FRANCISCO, CAL., March 1, 1890.

The report of the Treasurer was read, and on motion of Commissioner Block was adopted and placed on file.

REPORT OF THE EXECUTIVE COMMITTEE.

The Executive Committee then presented their report, as follows:

SAN FRANCISCO, CAL., March 1, 1890.

To the honorable State Board of Horticulture of California:

GENTLEMEN: Your Executive Committee beg leave to present for your consideration the following report, which is the result of their examination of the books, accounts, and vouchers in the office of the Secretary of the Board, as well as of all the property under the control of the Board, including office furniture, fixtures, library, etc., made at the office of the Board, February 24 and 25, 1890:

First—The book of original entry, covering the period from July 1, 1888, to February 8, 1890, every entry being examined in detail, clearly showed the amount paid and for what it was paid.

Second—We examined as a whole all the bills paid by the Board from date of removal

to present offices, about July 14, 1887, to February 8, 1890, and compared each bill with the receipt showing its full payment.

Third—We examined and appraised all the furniture, in most instances relying upon the bills for value, and where no bills were found the value was estimated.

Fourth—The library we found to contain the following number of books: Twenty-one volumes turned over by the former to present Secretary; two hundred and two volumes secured through exchange; six hundred and eighteen volumes bought, and two hundred and eighty-seven volumes bought in paper covers or witnout covers, and which have been bound or are in process of binding. One thousand one hundred and twenty-eight volumes in all, and valued as follows:

Twenty-one volumes, $210, estimated. The values of the following were ascertained from the bills: Nine hundred and five volumes, $1,235 90; two hundred and sixty-two volumes, $100. One thousand one hundred and twenty-eight volumes, $1,545, total value of library.

Fifth—Electrotypes and woodcuts, forming an exceedingly valuable collection, covering about eighteen superficial feet, cannot have cost less than $1,000, although we did not separate the bills of items, so as to determine the exact cost. These cuts and electrotypes number three hundred and sixty pieces, some of them as many as five separate subjects.

Sixth—We found an itemized account of old furniture, waste paper, rubbish, and truck sold, amounting to $79 50, said amount having been turned into the State Treasury.

Seventh—We found by the Secretary's report a balance of $2,214 27 remaining to the credit of the Board to carry on all its operations till the close of the present fiscal year, June thirtieth. The average monthly expenses for the nineteen months from July 1, 1888, to February 1, 1890, have been about $520. Applying this average to the remaining months of the present fiscal year, we find that $2,600 will be required. However, from this amount there should be deducted one month's rent, $135, not embraced in the above statement, and also the sum of $223 64, in value of postage stamps now on hand, thus leaving the amount at the disposal of the Board about equal to the probable expenses to be incurred before the close of the present fiscal year.

Eighth—A careful examination of the various rooms and offices of the Board disclosed the fact that the total value of the furniture, fixtures, carpets, etc., amounted to $2,700, which amount does not include the expense of putting up the various partitions, painting, etc.

Ninth—The actual running expenses of the Board, based on the amount disbursed in the nineteen months, July 1, 1888, to February 1, 1890 (not including salaries, which are provided for by law, nor the purchase of any permanent property), to be as follows:

Expenses of members of Board attending two Conventions	$640 00
Expenses of members of Executive Committee attending two meetings	540 00
Expenses, incidental, two Conventions	150 00
Expenses of stenographer, two Conventions	500 00
Traveling expenses of two clerks, two Conventions	160 00
Expense one year's rent, twelve months, at $135 per month	1,650 00
Incidental office expenses, twelve months	1,284 00
Postage stamps, $105 per month, twelve months	1,260 00
	$6,154 00

This estimate is based entirely on the average expenses of the Board during the period reviewed, but cannot fairly represent our future requirements, especially when we consider the constantly increasing demands made on the Board for many purposes, among which we may mention the increasing demand of fruit growers for experimental work in suppressing our numerous fruit pests, and the study of diseases of trees and plants; the largely increased expense of the annual report, consequent upon its increased size. The present report being larger than any previously published, a greater sum will be required in its distribution, not only in postage, but in express and freight charges, in drayage, in paper for wrapping, in boxes for transportation in quantity to Conventions and districts. In fact, we may say that the work of the Board is increasing so fast in importance that its expenses, with the most rigid and exacting economy, cannot be estimated at less than $6,250 for the coming fiscal year.

Tenth—A careful examination of the books of the Secretary develops the fact that during the period from April 17 to July 1, 1887, there was no money in the State Treasury with which to pay the absolutely indispensable expenses of the Board, and that the Secretary paid such bills to the amount of $414, and that no portion of such indebtedness has been refunded to Mr. Lelong. We also found that Mr. Lelong had also paid out $166 78 in discounts on State warrants, a part of such discounts having actually been paid to officers of the Board. We also found bills to the amount of $80 18, which were paid by the Secretary, and no part thereof has been returned to him.

We further found that while acting under the instructions of the Board, during the presentation and pendency of the amended horticultural bill before the Legislature, that the Secretary incurred expenses for traveling and other incidentals to the amount of $362 30, itemized statements being rendered for every disbursement. We, therefore, find that there is now due to Mr. Lelong the sum of $1,023 71, for moneys actually disbursed by him for account of the State Board of Horticulture, which sum does not embrace any charge for interest, which is properly chargeable for the use of his money.

For the coming fiscal year, June 30, 1890, to June 30, 1891, the appropriation is		$12,500 00
Minimum estimate for expenses	$6,250 00	
Due Secretary	1,023 71	
		7,273 71
Leaving a probable balance of		$5,226 29

The publications of the Board must sustain the enviable character of the horticulturists of our State, and to do it every step must be an advancing one; and in this regard, we may say that we believe the dissemination of exact knowledge deduced from experiments, through the medium of our publications, to be the most important feature in the work of our Board.

To summarize, we beg to say that after a careful examination of the offices of our Secretary, we find that his duties have been performed in an *exceedingly satisfactory* manner. We find the furniture and fixtures of the offices of the Board to be of a useful and not of an extravagant character, when the importance of this department is considered.

The general arrangement, neatness, and good order maintained at all times, is highly commendable to our Secretary, and is worthy of great praise.

Respectfully submitted.

FRANK A. KIMBALL,
J. L. MOSHER,
ELLWOOD COOPER,
Executive Committee.

Commissioner Block made a few complimentary remarks and said he was, indeed, very glad that such report was made, and moved that the report be received, adopted, and spread in full upon the minutes of the Board, as the sentiments of the Board toward the Secretary, for the efficient services performed by him since his accession to the office. Motion carried unanimously.

Commissioner Block moved that the Executive Committee be and are hereby given full power to settle the account due the Secretary in any way they choose. Motion carried.

On motion of Commissioner Block, Commissioners Cooper, Mosher, and Miles were appointed to draft a suitable set of resolutions in memory of the late General M. G. Vallejo, former Treasurer and Commissioner.

The President made a statement with regard to a parasite that is now destroying the red scale in Florida.

Commissioner Block moved that the Executive Committee be authorized to procure said parasite for distribution in this State. Motion carried.

On motion of Commissioner Block, the Secretary was granted a leave of absence of eight weeks, said leave to be taken under the direction of the Executive Committee.

On motion, the Board then took a recess, to meet at the call of the President, out of respect to the memory of the late General M. G. Vallejo.

MARCH 14, 1890.

The Board met pursuant to adjournment. All the Commissioners were present except Commissioner White.

The committee appointed to draft resolutions of respect to the memory of the late General Vallejo, submitted the following:

WHEREAS, It has pleased Almighty God to remove from our midst General M. G. Vallejo, our former Treasurer, and Commissioner for the Sonoma District; therefore, be it

Resolved, That in the death of General Vallejo we have lost a warm friend, and the State a dutiful servant, who for many years occupied the position of Treasurer to this department;

Resolved, That we, the State Board of Horticulture, in session at Los Angeles, this the fourteenth day of March, 1890, extend to the family of the late General Vallejo our sympathy and condolence in this their great bereavement;

Resolved, That these resolutions be spread in full upon the minutes of this Board, and that a copy be engrossed and attested to by the officers of this Board, and transmitted to the family of the late General Vallejo.

ELLWOOD COOPER,
J. L. MOSHER,
FRED. C. MILES,
Committee.

Commissioner Block moved that the resolutions be adopted and spread in full upon the minutes of the Board, and a copy be transmitted to the family of the late General Vallejo. Motion carried unanimously.

Commissioner Block moved that the next State Convention of Fruit Growers be held at Santa Cruz, the date thereof to be fixed by the President. Motion carried.

Commissioner Buck moved that when the Board does adjourn, it do so to meet at Santa Cruz, at the call of the President. Motion carried.

On motion of Commissioner Block, the subject-matter with regard to lithographic plates for the next annual report was referred to the Executive Committee, with full power to act.

The Board then adjourned.

SECRETARY'S REPORT.

OFFICE OF THE STATE BOARD OF HORTICULTURE,
SAN FRANCISCO, CAL.

The law as to the time to report was amended at the last session of the Legislature, from "biennially" to "annually;" therefore, we now present our reports annually, this report being the second submitted for your consideration since the passage of the Act.

The report for 1889 (the first made under the amended law) is a volume of 536 pages, and contains four colored lithographic plates, and the following is a digest of its contents:

First—Reports of the Treasurer, covering a period from April 15 to November 1, 1889, inclusive. In this report may be seen the total amount expended during that time. The reports of the Treasurer, following that period, are to be found in the present volume, up to the close of the forty-first fiscal year—June 30, 1890.

Second—Reports of the Secretary covering a period of a year, from November, 1888, to November, 1889. In that report may be seen a general outline of the amount of work performed during that year, and the amount of publications issued and distributed, and many other matters of vast importance. Attached to that report is a supplementary report in which fruit culture is treated at length. Among other things the following occupy the most prominent part of the volume: (*a*) The olive—botanical study, in which every point bearing upon the "oleaceæ and the olive" are brought out. (*b*) Chemical study of the olive; this being the most complete ever published, and is divided as follows: (1) Complete analysis of the soil; (2) mechanical analysis; (3) physico-chemical analysis; (4) chemical analysis; (5) analysis of the ashes of the wood, the leaves, and the fruits of the olive; (6) composition of the ashes of the wood, the leaves, and the fruit of the olive; (7) measurement of the tannin in the olive and bark; (8) immediate analysis of olives; (9) pulp analysis; (10) analysis of the endocarp; (11) analysis of the kernel; (12) relations between soil and plant; (13) what an olive can produce in wood, leaves, and fruit, yearly; (14) analysis of the oil cakes; (15) studies compared with the researches of other authors, and conclusions; (16) climate and abode of the olive; (17) vegetation and life of the olive tree; (18) temperature; (19) propagation; (20) varieties of the olive tree; (21) grafting and budding; (22) olive oil—analysis and methods of detecting adulterants.

Third—The culture of the fig is treated at some length, in which the latest processes of preparation are given, and also the same with regard to propagation, formation of the tree, production of fruit, etc.

Fourth—Grafting and budding the walnut is another subject treated at some length, the latest and most successful experiments being given. Many other subjects bearing on fruit growing are also fully illustrated.

Fifth—The strawberry tree, packing oranges, the lemon in Sicily, and tree planting, arrangement of the orchard, etc., receive much attention.

Sixth—Injurious insects are fully treated as follows: (*a*) Scale insects and remedies therefor; character of the Coccidæ, and their metamorphoses; division of the Coccidæ into sub-families, and their classification. (*b*) The Aphidæ, features of and reproduction, together with the most approved remedies. (*c*) Pear slugs and caterpillars. (*d*) Codlin moth, and remedies, time of application, etc. (*e*) The Eastern Plum Curculio, and other curculios, fully illustrated for comparison in identifying. (*f*) Tree borers. (*g*) Tree spiders or mites.

Seventh—The art of soap making in the field is one of great importance to every orchardist, as in this method no machinery or fire is required.

Eighth—The fungoid diseases are also fully illustrated, and the best means employed for their check are treated at length. The experiments made against the "pear cracking" and "leaf blight" have been very successful. The fungi treated are as follows: Pear blight (*Entomosphorium maculatum*); cherry, peach, and plum rust (*Puccinia pruni-spinosæ*); cherry powdery mildew (*Podosphæra oxycantha*); rose rust (*Phragmidium mucronatum*); rose leaf black spot (*Actinonema rosæ*); and strawberry leaf blight (*Sphærella fragariæ*).

Ninth—Beneficial insects also occupy a most prominent part, nearly all the species found on this coast being illustrated; "they should be reared and protected, as by their natural fecundity, which is very great, they assist most materially in the work of destroying injurious insects, and were it not for their aid they could not otherwise be destroyed effectually."

The *Vedalia cardinalis* (Australian ladybird) may be cited as an instance. A colored lithographic plate of this insect in its various stages appears, and the insect is again illustrated in Plate IV of this volume. Other beneficial insects of no less importance are also treated at some length.

It is our purpose to introduce all parasites and predaceous insects that may be discovered in other States and foreign countries. Already various lots have been imported and are now being propagated, with the object in view of distributing them among the orchardists of our State.

Tenth—The report contains, among other matters of vast importance to the fruit growers, the proceedings of the *Tenth, Eleventh, and Twelfth* State Fruit Growers' Conventions. The tenth was held at the City of Chico, Butte County, in November, 1888, the eleventh, at National City, San Diego County, in April, 1889, and the twelfth, at the City of Fresno, in November, 1889. These Conventions are held semi-annually in different parts of the State, it being understood that the spring Convention shall be held in the southern part of the State and the fall Convention in the northern or central part, as this time best suits the convenience of the fruit growers. By this arrangement the Conventions are held in the sections that are most interested in the subjects discussed at that time of year.

Our President, in his addresses at the various Conventions, has called special attention to all subjects to be discussed, and has taken particular care and pains in reviewing the fruit industry, together with sundry recommendations which the fruit growers have not been slow in advancing. In his address before the Tenth State Convention, held at Chico, November, 1888, he said: "Our fruit industry is rapidly increasing from year to year; our fruits are sought by the people in almost every part of the country; we have a growing demand, with an increased interest

in our products." Since then the methods of preparation and the improvements of varieties have received the greatest energies at the hands of the growers, by which they have been immensely remunerated. During 1890 the markets of the United States have been supplied almost with California fruits exclusively. The proceedings of the Tenth State Convention contains, besides the President's address, an address of welcome, by E. Graham, of Chico, and the following essays: "Insect Pests," by H. P. Stabler, of Yuba City; "Peach Culture," by P. W. Butler, of Penryn; "Cherry Culture," by James E. Gedney, of Mesa Grande, San Diego County; "Wheat vs. Fruit," by General N. P. Chipman, of Red Bluff, Tehama County; "Shall We Can or Dry our Fruits?" by R. C. Kells, of Yuba City, Sutter County; "Citrus Culture," by Jesse Wood, of Chico, Butte County; "Floral Culture," by Emory E. Smith, of San Francisco. Discussions followed the reading of all papers, which may be seen printed in full in the report.

Eleventh—The proceedings of the Eleventh State Convention contains an address by President Cooper, in which the fruit industry is reviewed at some length, together with many recommendations, which were acted upon, and an address of welcome, by Mrs. Flora M. Kimball, of National City, followed by the reading of the following essays: "Injurious Insects and Remedies," by Professor D. W. Coquillett, of Los Angeles; "Pruning and Cultivation," by Hon. Ellwood Cooper, of Santa Barbara, who afterwards read an essay on "Olive Culture;" "Irrigation and Protection of Water Sources," by L. M. Holt, of San Bernardino; "Fruit Packing," by Hon. L. W. Buck, of Vacaville; "The English (Madeira) Walnut," by Hon. Russell Heath, of Carpenteria, Santa Barbara County; "Japanese Nut and Camphor Trees," by H. H. Berger, of San Francisco; "Effect of Rain on Blossoms," by Gilbert Tompkins, of San Leandro, Alameda County; "Horticultural Machinery," by H. A. Brainard, of San José; "Orange Culture," by Fred. C. Miles, of Penryn, Placer County; "Lemon Culture," by Dr. O. H. Conger, of Pasadena, Los Angeles County; "Scale of Points for Judgment of Citrus Fruits," by J. E. Cutter, of Riverside, San Bernardino County; "Palms for Ornamental Purposes," by Professor Henry Chapman Ford, of Santa Barbara; "The Horticultural Resources of California—Southern California," by T. S. Van Dyke, of San Diego; and a full report of the products exhibited, together with various other matters affecting the fruit industry.

Twelfth—The proceedings of the Twelfth State Convention contains, as the former Conventions, an address by President Cooper, and an address of welcome by E. J. Griffith, of Fresno, and the following essays: "Fruit Pests and Their Extermination," by Louis W. Burr, of Bakersfield; "Nature's Methods of Subduing Insect Pests," by Prof. D. W. Coquillett, of Los Angeles; "Fig Culture and Seedling Smyrna Figs," by Hon. E. W. Maslin, of Loomis, Placer County; "Fruit Drying," by J. L. Mosher, of San José; "Resin Spray and Its Effects on Citrus Trees," by J. H. Kellom, of Tustin City, Orange County; "Floral Culture," by Mrs. Ellwood Cooper,* of Santa Barbara; "The Raisin Grape," by T. C. White, of Fresno; "The Mysterious Vine Disease," by Tim. Carroll, of Anaheim; "Fruit Culture in Fresno County," by Geo. E. Freeman, of Fresno; "Coöperation of Fruit Growers," by B. N. Rowley, of San

*Mrs. Cooper contemplates embodying her extensive researches into a treatise, which, if carried out, will be of great value to amateur and professional florists.

Francisco, together with many other reports, etc., followed by discussions.

Thirteenth—Extracts from the minutes of the Board of the various meetings from November 21, 1888, to November 4, 1889, synopses of the reports of the Special Agent, reports of the various County Boards of Horticultural Commissioners throughout the State, a roster of officers of National and State and County Horticultural Societies and Commissions, Glossary on Entomology and Botany, conclude the volume. Besides the four colored lithographic plates, the report contains one hundred and thirty-seven wood engravings of fruits, fungoids, injurious and beneficial insects, etc.

PUBLICATIONS.

There has been considerable demand on the part of fruit growers and newcomers into our State for the publications of this Board, as they contain the information required by beginners, as well as supplying information to the masses interested in the fruit industry.

The demand for our last annual (1889) report was so great that it has been impossible to supply the applications for copies made upon us. The various schools throughout the State made urgent requests to be supplied with enough copies for each school district. I regret very much that their wants could not be satisfied, as at least one hundred and twenty-five thousand copies would have been required, as there are at least twenty-five or more school districts in each of the fifty-three counties of our State. A single demand made by an educational department would have required fifty-two hundred copies. I have supplied all the school and public libraries with bound copies, but regret to say that the many school districts throughout the State have only been supplied with one copy each, as the issue became exhausted, the demand for them being so large and the amount printed (ten thousand) proving inadequate.

Various bulletins have been published from time to time, which have supplied information required at the various periods of the year. During a leave of absence allotted to me, I visited during the months of April and May, 1890, several of the Eastern and Southern States, in search of information in relation to the fruit industry. I visited all the largest fruit-growing districts in Florida, Maryland, Delaware, and New Jersey; also other States of less importance in horticulture. The results attained were published and distributed in bulletin form.

The lithographic plates in the present volume were designed by me and sketched in water colors by our artist, Mr. Chris. Jorgensen, to whom special credit is due for the able manner in which the work was executed. The lithographing was executed by H. S. Crocker & Co., of San Francisco, and speaks for itself, and also establishes the fact that there is no further need of sending such work abroad when satisfactory results can be obtained at home. The biennial reports for the years 1885, 1886, 1887, 1888, and 1889, are about exhausted.

CORRESPONDENCE.

The correspondence for the past year has been very large; numerous letters are received every day from all sections throughout the State; the scope of inquiry being upon topics of interest to those particular

sections. In every case they have been given prompt and due attention. The correspondence with Ministers and Consuls in foreign countries is still kept up, and considerable good has been accomplished through it. I am informed that the reports received from the Consulates by the Department of State, United States, are now being printed, and we shall soon receive printed copies for distribution. It is to be hoped that this report will impart the desired information upon kindred subjects, that would aid the horticulturists of this State. With this view I arranged the list of questions, and made them as broad as possible to cover the subjects upon which information is sought. The following is a copy of the instructions forwarded to the Consulates:

DEPARTMENT OF STATE,
WASHINGTON, September 28, 1889.

To the Consular Officers of the United States:

GENTLEMEN: At the request of the California State Board of Horticulture, acting through Mr. B. M. Lelong, its Secretary, the inclosed series of questions relative to the cultivation of oranges, lemons, figs, and olives, is sent to you for reports. You are requested to give such information in response thereto as you can acquire without expense to the Government or to yourselves. But should you find it impracticable to make a satisfactory report without outside aid, you will submit to the Department an estimate of the anticipated cost before you obligate yourself for any specific sum.

I am, gentlemen, your obedient servant,

ALVEY A. ADEE,
Acting Secretary.

MEMORIALS TO CONGRESS.

I have forwarded to the Senators and Representatives from this State, copies of all the resolutions and memorials adopted at the various Conventions held throughout the State. These have been introduced by them in both Houses. I also appeared, while at Washington, before the House Committee on Adulterated Goods, and laid before them all matters intrusted to my care. It is to be hoped that they will be given due consideration.

HORTICULTURAL COMMISSIONERS.

The following are the County Boards of Horticultural Commissioners appointed by the various counties throughout the State since the amendment of the Act, March 19, 1889:

Alameda County Horticultural Commission.

A. D. Pryal, President	Temescal.
Wm. Barry	Alameda.
A. P. Crane, Secretary	San Lorenzo.

Butte County Horticultural Commission.

C. J. Berry, President	Biggs.
Ed. Harkness	Oroville.
G. M. Gray, Secretary	Chico.

Colusa County Horticultural Commission.

J. R. Totman, President	Colusa.
F. M. Johnson	Colusa.
Frank W. Willis, Secretary	Colusa.

El Dorado County Horticultural Commission.

J. H. Thomas, President	Coloma.
E. W. Meglone	Granite Hill.
R. P. Patterson, Secretary	Placerville.

Humboldt County Horticultural Commission.

J. D. Barber, President	Rohnerville.
Jacob Zehendner	Rohnerville.
A. P. Campton, Secretary	Rohnerville.

Kern County Horticultural Commission.

M. Wyatt, President .... Bakersfield.
C. A. Maul .... Bakersfield.
L. W. Burr, Secretary .... Bakersfield.

Los Angeles County Horticultural Commission.

A. F. Kercheval, President .... Los Angeles.
Geo. E. Mitchell .... Pomona.
F. Edward Gray, Secretary .... Alhambra.

Mendocino County Horticultural Commission.

C. R. Thomas, President .... Ukiah.
Mart. Baechtel .... Mendocino.
Carl Purdy, Secretary .... Ukiah.

Nevada County Horticultural Commission.

John Rodda, President .... Grass Valley.
Henry Waters .... Nevada City.
J. R. Vineyard, Secretary .... Anthony House.

Orange County Horticultural Commission.

H. Hamilton, President .... Orange.
F. H. Keith .... Anaheim.
S. W. Preble, Secretary .... Tustin City.

Placer County Horticultural Commission.

M. W. Baker, President .... Colfax.
H. E. Parker .... Penryn.
Geo. W. Applegate, Secretary .... Applegate.

San Benito County Horticultural Commission.

G. Brown, President .... Hollister.
E. W. Bowman .... San Juan.
J. A. Schofield, Secretary .... Hollister.

San Bernardino County Horticultural Commission.

H. B. Muscott, President .... Santa Barbara.
Bradford Morse .... Riverside.
W. E. Collins, Secretary .... Ontario.

San Joaquin County Horticultural Commission.

Joseph Hale, President .... Stockton.
Geo. W. Wise .... Stockton.
W. H. Robinson, Secretary .... Stockton.

San Mateo County Horticultural Commission.

Wm. J. McNulty, President .... Woodside.
Alex. Moore .... Redwood City.
Dr. L. D. Morse, Secretary .... San Mateo.

Santa Barbara County Horticultural Commission.

T. N. Snow, President .... Santa Barbara.
R. Machin .... Lompoc.
O. W. Maulsby, Secretary .... Santa Maria.

Sonoma County Horticultural Commission.

John M. Balhache, President .... Healdsburg.
Mark L. McDonald .... Santa Rosa.
E. A. Rogers, Secretary .... Santa Rosa.

Sutter County Horticultural Commission.

R. C. Kells, President .... Yuba City.
J. C. Gray .... Yuba City.
H. P. Stabler, Secretary .... Yuba City.

Tulare County Horticultural Commission.

J. N. Wright, President .... Visalia.
C. M. Stone .... Hanford.
N. W. Motheral, Secretary .... Hanford.

Ventura County Horticultural Commission.

N. W. Blanchard, President........Santa Paula.
N. B. Smith........Ventura.
M. E. Isham, Secretary........San Buenaventura.

Yuba County Horticultural Commission.

G. W. Harney, President........Marysville.
Jas. W. Mills........Marysville.
F. W. Johnson, Secretary........Marysville.

MEETING OF HORTICULTURAL COMMISSIONERS.

The Horticultural Commissioners, representing the various County Boards throughout the State, assembled for the first time in Convention at Los Angeles, on March 11, 1890. The meeting was called for the purpose of devising some plan by which the Commissioners could communicate with each other upon topics of importance in the discharge of their duties, and also for the purpose of perfecting a permament organization and a general interchange of ideas.

I had the honor of calling the Convention to order, and of addressing the delegates assembled on the importance of the work before the Convention to the fruit interest of the State. A permanent organization was then effected, and W. E. Collins, of Ontario, San Bernardino County, was elected Chairman, and H. P. Stabler, of Yuba City, Sutter County, Secretary.

Mr. Collins, on taking the chair, reviewed the work performed by the various Commissions throughout the State, and also the work performed by his own Commission, and outlined a plan of action for the future.

Nearly all of the twenty-one County Boards of Horticultural Commissioners were represented in the Convention. Various Commissioners addressed the Convention as to the work performed by their respective Boards and Inspectors, who were listened to with much interest.

On motion, M. E. Isham, of Ventura County, and H. P. Stabler, of Sutter County, and E. A. Rogers, of Sonoma County, were appointed a Committee on Order of Business, and, pending a report from said committee, a recess was taken.

On reassembling, the Convention proceeded to roll call of the various counties represented, and reported the rates of compensation allowed by the counties.

The following resolution was adopted:

WHEREAS, Insect pests are rapidly spreading in many parts of the State, and several fruit-growing counties are yet without County Boards of Horticultural Commissioners, which are indispensable in the work of exterminating insect pests; therefore, be it

Resolved, By the County Boards of Horticultural Commissioners in Convention assembled, that we do earnestly recommend the appointment of County Boards of Horticultural Commissioners in all fruit-growing counties, and we ask the Boards of Supervisors to adopt a liberal policy to the Commissions when appointed.

For the purpose of avoiding the spread of noxious insects by nursery stock, a resolution was adopted requesting the various Commissions throughout the State to inform each other at the proper season as to the condition of the various nurseries in regard to pests.

At the various meetings during the week there were full and exhaustive discussions on insect pests, spraying, quarantine regulations, and proposed changes in the laws relative to their suppression.

The meetings proved of much value, and were pronounced a decided

success. The Convention, after having received reports from the various committees appointed, and having given them instructions to report at the next meeting, adjourned to meet at the call of the Chairman, at Santa Cruz, in November, at which time and place the Fourteenth State Fruit Growers' Convention will convene.

QUARANTINE GUARDIANS.

The following Quarantine Guardians have been appointed since my last report, viz.: M. H. Baldwin, William Barber, E. B. Flack, John Scote, Harvey E. Smith, Henry Waters, J. R. Vineyard, M. W. Baker, George W. Applegate, H. E. Parker, Edward Polifka, A. M. Pettingill, H. C. Oakley, George Vankirk, W. R. McCully, Fred. Mascott, W. H. Ingelow, H. M. Waldo, David Gregerson, H. H. Ruggles, W. G. Jasper, John Guill, T. B. Huchings, J. W. Benson.

THE LIBRARY.

The following books have been added to the Library (excepting those marked with an asterisk) since our last report. It has been our aim to secure all the standard works on horticulture that have been published in the United States and in foreign countries. We have secured mostly all such publications, and all reports, etc., issued by the horticultural societies, schools and colleges of horticulture and agriculture, of the country. These are of great value, and are indispensable to the student of horticulture and kindred subjects:

AUTHOR.	Name of Book.
Alderton	Orange Culture in New Zealand; 2 vols.
Alfonso	Coltivazione degli Agrumi.
Allemao	Monoc. and Dic. Plants.
Allen	* New American Farm Book.
Allen	Commercial Organic Analysis.
Aloi	Prezzio Lire.
Aloi	The Olive and Olive Oil.
Ashmead	Orange Insects.
Ayer	American Newspaper Annual.
Baccarini	Colori nei Vegetati.
Balfour	Asafœtida Plants.
Barba	Orchidees de Nice.
Bailey	Synopsis of Queensland Flora.
Baker	* Practical and Scientific Fruit Culture.
Ballard	* Insect Lives.
Barry	* Fruit Garden.
Baillon	History of Plants; 9 vols.
Baillon	Botanical Dictionary; 4 vols.
Bentham	Olacineæ.
Bentham	Campan. and Oleac Orders.
Berkeley & Broome	Brisbane Fungi.
Berkeley & Broome	Ceylon Agaricus.
Berkeley	Handbook of British Mosses.
Berkeley	Cryptogamic Botany.
Berkeley	Gleanings of British Algæ.
Berkeley	Cuban Fungi.
Berkeley	Ceylon Fungi.
Berkeley	Fungi.
Bennett	The Orange in New South Wales.
Bennett	Valles spir. Flower Stalk.
Bennett	Hyacinth Flower Stalk.
Bennett	Impatiens Fulva.
Bennett-Murray	Cryptogamic Botany.
Bertrand	Botany.

Author.	Name of Book.
Bowers & Vines	* Practical Botany.
Berger	* Pomologie Generale; 12 vols.
Barry	* Fruit Culture.
Brannt	Vinegar Acetates, Cider, Fruit Wines, Preservation of Fruits.
Breuil	Fruit Trees.
Brill	Farm Gardening and Seed Growing.
Buckton	*Monograph of the British Aphides; 4 vols.
Bernays	*Horticultural Industries of Queensland.
Black	Cultivation of the Peach, Pear, Quince, and Nut-bearing Trees.
Bleasdale	The Olive Tree.
Brown	*Book on Butterflies.
Brannt	Animal and Vegetable Fats and Oils, Artificial Butter, and Lubricants.
Brannt	Techno-chemical Receipt Book.
Blyth	Foods: Composition and Analysis.
Brebms	*Entomology (in German).
Cameron	*Monograph of the British Phytophagous Hymenoptera; 2 vols.
Cappe	Cultivation of the Olive.
Caruso	The Olive.
Cooper	The Olive.
Comstock	Entomology.
Contance	The Olive.
Cooke	School Entomology.
Cooke	*Injurious Insects of California.
Cooke	Brazilian Fungi.
Cooke	*Microscopic Fungi.
Curtis	*Farm Insects.
Curtis	Trade between United States and Spanish America.
Culver	*Fruit Preservers' Manual.
Crocker	Parliamentary Procedure.
Cushing	Manual.
Copeland	Country Life.
Crozier	Culture and Rearing of Silkworms.
Cox	Mines and Minerals.
Cox	*Hand Book of Coleoptera; 2 vols.
Chapin	Scale Insects.
Coquillett	Methods of Destroying Scale Insects.
Cooke (M. C.)	Grevillea.
Cole	American Fruit Book.
Davis	* Culture of the Orange.
Des Cars	Tree Pruning.
De Mueller	Species Plantanum.
Dreschel	Chemical Reaction.
De Puy	People's Cyclopedia.
Draper	Chemistry of Plants.
Dewey	Picturesque California.
Downing	* Rural Essays.
Downing	* Fruit and Fruit Trees of America.
Downing	* Selected Fruits for Garden and Market.
Douglas & Scott	* British Hemiptera.
Duncan	* Transformation of Insects.
Del Amo	Memoria.
Elliott	* Hand Book for Fruit Growers.
Elliott	* Western Fruit Growers' Guide.
Estabrook	Photography in the Studio and Field.
Enfield	* Indian Corn.
Ellwanger	* The Rose.
Forbes	Poisons for Codlin Moth.
Forbes	Noxious and Beneficial Insects.
Flamant	* Olive Culture.
Flint	* Harris' Insects Injurious to Vegetation.
Flint	* Poultry Breeding.
Figuier	* The Insect World.
Fulton	* Peach Culture.
Fresenius	Manual of Quantitative Chemical Analysis.
Fresenius	System of Instruction in Quantitative Chemical Analysis.
Fuller	Hop Culture.
Fuller	Strawberry Culturist.
Fuller	* Small Fruit Culturist.
Fuller	Propagation of Plants.
Fitz	* Sweet Potato Culture.

Author.	Name of Book.
Flagg	* Hand Book of Sulphur-Cure.
Frankland	Agricultural Chemical Analysis.
French	* Farm Draining.
Gallesio	* Treatise on the Citrus Family.
Glenny & Ormerod	* Peach and Nectarine Culture.
Garey	* Orange Culture in California.
Grindon	Plant Life.
Gilman	Profit Sharing between Employer and Employé.
Galloway	Treatment of Fungous Diseases on Plants.
Hooker	Plants of Galapagos Archipelago.
Hubbard	Rust on the Orange.
Hance	North China Plants.
Hogg	Apples and Pears; 2 vols.
Hogg	* Fruit Manual.
Henderson	Hand Book of Plants.
Henderson	* Practical Floriculture.
Henderson	Gardening for Profit.
Hall	Irrigation—California.
Hall	Irrigation Development.
Heinrich	Window and Flower Garden.
Haldane	Subtropical Cultivations and Climates.
Hilgard	Alkali Lands.
Hilgard	Methods of Fermentation.
Hart	Plants of Ireland.
Husmann	* American Grape Growing and Wine Making.
Jaeger	* Life of North American Insects.
Joly	Les Orangeries.
Johnson & Hogg	Journal of Horticulture.
Kingsley	* Riverside Natural History; 6 vols.
Kirby & Spencer	* Entomology; 2 vols.
Kern	Practical Landscape Gardening.
King	* Bee Keeping.
Klee	Insects Injurious to Fruit and Fruit Trees of California.
Leconteux	Rural Economy.
Langstroth	*The Honey Bee.
Lindsay	Foot Plant and Poison of New Zealand.
Llaurado	Pamphlets.
Lindley	Horticulture.
Lelong	The Olive.
Lelong	Citrus Culture in California.
Lewis	Los Angeles County.
Lintner	Pests of the Pomologists.
Le Maout	Les Trois Regnes Botanique.
Linnæus	Flora Dalekailica.
Linnæus	Botanical Nomenclature.
London	*Encyclopedia of Plants.
Lubbock	*Monograph of the Collembola and Thysanura.
Langley	San Francisco Directory; 4 vols.
Merrill	Chemical Reaction.
Masters	Passifloraceæ.
Masters	Passiflora of Ecuador and New Granada.
Marvin	The Olive.
Maw	The Genus Crocus.
Mutel	Flore Française.
Maskell	*New Zealand Insects.
Moore	Census of Plants of New South Wales.
Moore	*Handbook of Orange Culture.
Manning	Book of Fruits.
Miers	Oleaceæ Genera.
Murray	Economic Entomology.
Marcourt	*Florida Fruits.
Moule	Vegetation, Creation, and God.
Morris & Henderson	Ringworm Fungus.
McKenney	Pacific Coast Directory, 1887-88.
Newman	Illustrated Natural History of British Moths.
Nilson	Timber Trees of N. S. W.
Norton	Elements of Scientific Agriculture.
Neken	Preparing, Treatment, and Examination of Wine.
Neck	Present and Future Productions of Florida.
Ormerod	Injurious Insects and Common Farm Pests.
Ormerod	* Guide to Methods of Insect Life.

Author.	Name of Book.
Ormerod	Injurious Insects and Methods of Prevention.
Ormerod	Injurious Insects.
Ott	Soap and Candles.
Orange Judd	* My Vineyard at Lakeview.
Orange Judd	* Flax Culture.
Orange Judd	* Tobacco Culture.
Orange Judd	Farm Conveniences.
Polk	California State Gazetteer, 1888.
Porter	Forestry of Europe.
Potter	Agriculture in Germany.
Perkins	Elementary Quantitative Chemical Analysis.
Paxton	* Botany; 16 vols.
Parlatore	Italian Flora; 8 vols.
Parsons	The Rose.
Pardee	Strawberry Culture.
Phin	* Open Air Grape Culture.
Pierre	Agriculture.
Parparelli	Olive Culture.
Pecori	Culture of the Olive.
Packard	* Half Hours in the Tiny World.
Packard	* Guide to the Study of Insects.
Quinn	* Pear Culture for Profit.
Quincy	* Soiling for Cattle.
Quinby	* New Bee Keeping.
Ridpath	History of the World; 3 vols.
Robinson	Facts for Farmers and the Family Circle.
Roe	* Success with Small Fruits.
Rye	* British Beetles.
Riley	* Locust or Grasshopper Plague.
Rivers	* The Orchard House.
Rivers	* The Fruit Garden.
Rorer	Canning and Preserving.
Riondet	Agriculture in France.
Rixford	* The Wine Press and the Cellar.
Robinson	Letters on Landscape Photography.
Saunders	*Insects Injurious to Fruits.
Stockhardt	*Chemistry of Plants.
Scott	Nurserymen's Universal Directory.
Scott	Passiflora.
Scribner's Sons	*Encyclopedia Britannica; 25 vols.
Smith	Plants with Perfect Seeds.
Smith	British Hymenoptera.
Smith	*Diseases of Field and Garden Crops.
Storer	Agriculture; 2 vols.
Schenck	Gardeners' Text-Book.
Scudder	Butterflies.
Stoddard	Encyclopedia Americana; 3 vols.
Stephens	British Beetles.
Spry	British Coleoptera.
Strong	*Fruit Culture.
Stockhardt & Heaton	*Experimental Chemistry.
Spaulding	*Orange Culture in California.
Triplett	New Law and Form Book for Business Men.
Thorpe	Quantitative Chemical Analysis.
Todd	*Apple Culturist.
Treat	*Injurious Insects of the Farm and Garden.
Turner	*Cyclopedia of Practical Floriculture.
Thomas	*American Fruit Culturist.
Turrill	Products of California.
Turrill	California Exhibits at New Orleans.
Tulasne	Fungi.
Traill	Photographic Amateur.
Von Mueller	Select Extra Tropical Plants.
White	Gardening for the South.
White	Cranberry Culture.
Waring	*Draining for Profit and Health.
Wood	*Rennie's Insect Architecture.
Willet	*Wonders of Insect Life.
West	Petals of Flowers.
Wilson	*Our Farm Crops.
Westwood	*British Moths.

Author.	Name of Book.
Westwood	*Arcana Entomology; 2 vols.
Westwood	Insects.
Westwood	*British Butterflies.
Wickson	California Fruits.
Wickson	California Illustrated.
Woods	*Insects at Home.
Wheeler	Michigan Flora.
Waring	Elements of Agriculture.

Codes.

*Political Code of California, 1885.
*Code of Civil Procedure, 1885.
Deering's Annotated Codes and Statutes of California—Civil Code.
Deering's Annotated Codes and Statutes of California—Penal Code and Statutes in Force.
Law and Practice of Legislative Assemblies.
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In the supplement to this report the results of the investigations carried on since the issuance of our last annual report (1889) are given, together with later notes.

Very respectfully,

B. M. LELONG,
Secretary.

CONVENTION OF FRUIT GROWERS.

PROCEEDINGS OF THE THIRTEENTH STATE FRUIT GROWERS' CONVENTION.

OPENING DAY.

Los Angeles, Cal., March 11, 1890.

ORDER OF BUSINESS AND SUBJECTS FOR DISCUSSION.

Tuesday, March 11, 1890.—The Convention assembled at 10 o'clock A. M.

1. Calling to order by the President.
2. Election of two Vice-Presidents.
3. President's semi-annual address.
4. Address of welcome.

Afternoon Session, 2 o'clock.—"Insect Pests and their Extermination."

Wednesday, March 12, 9:30 A. M.—"Planting, Cultivating, and Pruning."
Afternoon Session.—Excursion to Pasadena.

Thursday, March 13, 9:30 A. M.—"Selecting, Preparing, Packing, and Marketing Fruits."
Afternoon Session, 2 o'clock.—"Olive Culture and Citrus Fruits."
Evening Session.—"Floral and Forest Culture."

Friday, March 14, 9:30 A. M.—"Fig Culture, Table and Raisin Grapes, and Small Fruits."
Afternoon Session—"Diseases of the Vine;" "Tariff on Fruits;" unfinished business, and arrangement for next Convention.

CALLED TO ORDER.

Hon. Ellwood Cooper, President of the State Board of Horticulture, called the Convention to order promptly on time. Rev. Eli Fay, of Los Angeles, opened with prayer.

ELECTION OF VICE-PRESIDENTS.

The President announced that it would be in order to select three Vice-Presidents. The following persons were elected: J. B. Lankershim, Dr. J. P. Widney, of Los Angeles, and Dr. O. H. Conger, of Pasadena, who took their places on the stage.

At the opening of the Convention, there were on the platform, besides the President and Vice-Presidents, Governor R. W. Waterman, His Honor

Henry T. Hazard, Mayor of Los Angeles; Colonel E. W. Jones, President of the Chamber of Commerce; Rev. Eli Fay, Dr. O. H. Conger, Hon. L. W. Buck, the Vice-President, and various members of the State Board of Horticulture, and Secretary.

OPENING ADDRESS.

By Hon. Ellwood Cooper, President of the Convention.

(Vice-President L. W. Buck in the chair.)

President Cooper: Ladies and Gentlemen: This will be the thirteenth State Fruit Growers' Convention, and the ninth held under the auspices of the State Board of Horticulture. It has been my privilege to preside at these Conventions, beginning with that held in Los Angeles, in November, 1885.

At that Convention, and at each subsequent one, I called your attention to the important questions which I thought most concerned us. So many times have I repeated these subjects and enlarged upon any special line of interest as manifested in the discussions, that I do not consider it necessary to present the same views again. In the first instance, a statement somewhat in detail seemed fitting and proper; now, most of you are as familiar with the subjects as myself. Those who are new in the line of seeking horticultural knowledge, I refer to the reports which we have here for gratuitous distribution, and to the programme presented, which outlines the discussions of this Convention.

At this time, and in the future, should I hold my present position, and feel it my duty to make an opening address, I will confine my remarks to some special subject or subjects, the importance of which may have been impressed upon me by the discussions at the preceding Conventions. In this instance it is the vine disease.

At the Fresno Convention, held in November last, there were four distinct theories presented to account for this terrible calamity which has spread over parts of Los Angeles County and adjoining districts; also one suggestion.

The Fresno people maintained that in their county all the vines that had died could be accounted for by bad drainage and alkali; that no disease had appeared there, and that no danger was apprehended. The suggestion offered was, that everything has a period of life, and there was a possibility that the period of life of the grapevine was nearing its end, and would sooner or later disappear from the face of the earth. The first theory advanced gave the cause as poverty of soil, the vines dying from lack of sap or poisonous sap.

The second theory claimed that by the cultivation of trees and plants in Los Angeles County the climate was changed, and becoming more tropical was not adapted to vine growing in the localities where the disease had made such havoc.

The third theory contends that too early pruning was the cause.

The fourth theory held that it was a disease not yet understood, and was spreading with alarming rapidity.

I believe it was generally conceded that the vines died at the top first, that is to say, from the top downward, and not from the root

upward, which is usual with plants. The different authors of these theories were persistent in impressing their views, which indicated a conviction on their part. It is characteristic of our American people that when anything out of the usual course occurs, every individual rushes after a theory of his own make up, and those who are not directly interested, after having matured a theory, let the matter rest and assume an indifferent position as to the result. We are all indirectly sufferers and should be united as one mind, free from bias, to ferret out the cause and find a remedy.

At said Convention there were also many severe expressions made criticising experts who were investigating this malady, almost to the extent that they were wrong in all their conclusions. Such a sentiment, if encouraged, will lead us backward instead of forward. I was extremely sorry that any such expressions should have been made. I am conscious that scientists may make mistakes, but all are not on the wrong line of investigation. To the specialist we must look for the solution.

I have made no examination, and have seen but little of the vineyards where the disease was prevalent, but I have listened to the statements of the different parties who have examined the vineyards in different localities, experts as well as owners, neighbors, and sufferers, and have gathered such information as leads me to the following conclusions:

First, as to the suggestion that the vine might be nearing its end, I am not prepared to seriously consider such a condition. It is true that many plants that once flourished do not now exist, but their disappearance is accounted for by great convulsions and climatic changes that made their further growth and life impossible. It is also true that some scientists have suggested that the two species of Platanus, the one known on the Atlantic Coast as the buttonwood, the other on this coast as the sycamore, were approaching their end, since for several years they have been subject to serious blights all over the world. This takes place every spring. From this supposed weakness scientists have concluded that the final end was near, but may it not be a disease that could be successfully treated. The loss to the world of the grapevine is more than I am willing to believe is probable.

The first, second, and third theories—poverty of soil, more tropical climate, or too early pruning—do not satisfy my mind as to the probable cause. Young vines on virgin soil of the best quality have succumbed. Grapes of the finest quality are produced in the tropics, besides there has been no material change in climate. Pruning could not be the cause, as wild vines in the cañons, grown for ages without being disturbed, have died. Neither bad drainage nor alkali will account for it. The fourth theory, that it is a disease, is not so easily disposed of. Experts have asserted that the microscope could not detect any fungi; that the root of the affected vine, compared with one in a healthful condition, was exactly the same; that it was a sort of paralysis or a wilting death without any apparent cause. The impossibility of discovering these poisonous particles, by reason of their minuteness, proved nothing, because if we consult the New American Cyclopædia, page 246, where it describes this character of fungi under the head of "Oidium albicans," vegetable parasites of man, and "Oidium Tuckeri," known as Mildew Tuckery, or vine mildew, which has proved such a destructive pest to

the vineyards of southern Europe and Madeira, we will find this statement: "That neither time nor the powers of chemistry avail aught against them, which are so subtile in their invisibility, and may be wafted from one point of the earth to another by wind and wave." It seems to me, therefore, that it is safer for us to conclude that it is a fungous growth of a poisonous character; that the particles float and are carried through the air, and taking root in the tender leaves, grow and kill the vine, notwithstanding the fact that the particles and the fungous growth may be so minute, so subtile in their character, that they remain as yet undiscovered.

In my experiments with poisonous substances, in a mild form, for spraying trees, I found that wherever the insects were touched they were killed. The second or third day afterwards the tender shoots began wilting. This continued by degrees until all the tree above ground was dead. I practiced the clipping off of the branches, thinking to arrest the poisonous influence, but it was ineffectual. In cutting the wilting branches I found a black streak between the bark and wood. I would keep on cutting until I found the natural appearance; still the poison would work its way downward until the roots were reached. When the effect ceased, new shoots were thrown up and they are now growing. The trees with which I experimented were the olive and lemon, the effects being about the same on both. The poison entered through the pores, united with the sap, and killed the tree above the roots, but why the roots were not killed is more than I can comprehend. I have understood that the vine disease acts to a certain extent in a similar way; that is, the top wilts and dies the first year without necessarily killing the roots. The second year new shoots are thrown out, but wanting in vigor easily succumb to the disease, and the root follows. I sincerely hope that much new light will be given on this subject during the sessions of this Convention.

PARASITES, AND PREDACEOUS INSECTS.

I desire to call your special attention to this branch of our horticultural work. The success in fighting the red scale with the resin wash, the San José scale with lime, salt, and sulphur, and the codlin moth with arsenic washes and the Thistle trap, ought not to divert our attention from searching for parasites to pit against these insects and destroy them in the manner Nature intended. I stated at the Fresno Convention that the law would not permit the State Board to expend money in sending an entomologist to foreign countries to search for parasites. We should not relax our efforts in trying to secure this work from the National Government.

I have read recently a report on insects and fungous pests by Henry Tryon, of Queensland, Australia, published in Brisbane in 1889. I find on examination of this work that they have many noxious insects very destructive in their character, preying upon fruit and fruit trees that have not yet appeared in our State. The greatest precaution should be exercised in the examination of all plants landed on this coast from that country. I have been deeply interested in the numerous parasites that are also found there, as described in said work, and the opinion that I always maintained, viz.: that we must look to Australia for para-

sitic insects to aid us in combating noxious insects, has been fully confirmed.

On page 16, in speaking of the coccinellidæ beetle, he says: "Wherever aphides exist there, there are ladybirds in the larval or adult condition to feed upon them. It is for destroying our scale insects that the coccinellidæ are here most highly useful. To mention but a single instance, that of a small black beetle reddened at each extremity, belonging to the group "Scymnites" and named cryptolœmus. The larva of this is a small active grub measuring about one fourth inch in length, covered above with six rows of contiguous elongated white mealy secreted appendages. Quite recently the bunya bunyas and other auricaraceous trees growing about Brisbane have been infested by a coccus insect, an apparently undescribed species of dactylopius, which affects especially the spot where the leaves and branches unite, and the insects were at one time so numerous that the death of these valuable trees from their attacks seemed very imminent. However, the cryptolœmus beetle also visited the auricaries, and in some places its larvæ occurred in such profusion that the trunks of these trees and the ground around their bases looked as if flour had been dusted in patches here and there upon them. Both in its adult and larval condition it waged war upon the coccid insects, and as a result these trees are saved from destruction. This friendly insect is none other than the one which is met with on various native trees, especially acacias, and also on the citraceous and other economic plants of our gardens. Here also it visits for the purpose of ridding them, or at least checking the increase of the various scale insects, especially those belonging to the lecanidæ, which infest these trees, and these pests it literally mows down to the surface of the leaf, so great is its voracity."

Again, on page 17, he says: "In 1873 it was brought under the notice of the Secretary for Agriculture, Victoria, that one of these insects, namely, *Bracon capitata*, was a very effectual enemy to the grasshoppers, one informant stating that he had noticed that when the locusts were most numerous this ichneumon fly was to be seen in great force."

Count Castlenau, the celebrated entomologist, in reference to this insect, stated also: "This parasite is most important, as I believe it will be to it alone that we may one day owe the disappearance of the locust." Again, on page 18, he says: "The most remarkable case, however, is that of a moth which, in Australia, rids us in great measure of our scale insects. Public attention was first directed to its existence by Mr. G. Masters, at a meeting of the Linnean Society of New South Wales, held in 1885, at which he exhibited some small moths (afterwards named *Thalpochares coccophagus*) bred from caterpillars found feeding on a coccus which infested the common Zamia. These caterpillars, Mr. Masters remarked, in the course of a few days completely cleared the plant of the scale, devouring the coccus and forming with the scales, or empty skins, complete coverings for themselves, which they carried about on their backs. They fed at night, and during the day fixed themselves securely to the midrib of the frond. Now, this useful insect is exceedingly common both in the Toowoomba and Brisbane districts, and it is probably widely represented in southern Queensland. Every tree in these districts which is infested with black scale (*Lecanium oleæ*) will afford examples of *Thalpochares coccophagus*. Strange to observe, we have never met with one in this colony who has

recognized the rolė of this insect. Whenever, at Toowoomba, we sought typical examples of the black scale for study, we were directed to examine the angles between the branchlets of the orange tree for 'extra fine examples' of the coccus we were in quest of. Indeed, we found more than once that these alone remained, together with fumagine, to attest the previous occupancy of these trees by the scale insect in question. In these instances the species of mimicry which Nature had evidently wrought (with such perfection as to effect in this caterpillar a resemblance to extra fine examples of black scale) to serve for this caterpillar as a safeguard from destruction at the hands of the ordinary foes of insect life, tend only to insure its being killed, its utility being overlooked." A further description of this insect is to be found on page 126. I will not copy further, but the numerous parasites and predaceous insects described in said work ought to impress upon our minds the importance of an immediate investigation, even if only a semblance of fact should be credited to the report.

I urge, therefore, that we memorialize Congress for an adequate appropriation to defray the necessary expenses of a specialist to go to Australia and adjacent islands, to investigate these reported predaceous insects; and to petition the National Government to send Professor Albert Koebele as such specialist at the earliest possible moment, with instructions to collect such parasitic insects as are found preying upon noxious insects, and send them to Professor D. W. Coquillett for colonizing and distribution in California and other parts of the United States.

I also desire to call your attention to the fact that we are extending our fruit orchards, which will enormously increase the fruit product, and that no united effort is being made to better distribute the fruits. There seems to me to be great danger in rival fruit companies rushing large quantities of fruit into the same market, depressing the prices and causing serious losses to the growers. Merchants who handle or sell goods, having no interest except the commission, as a matter of course make more or less money, according to the bulk of their business.

The fruit growers cannot expect to sell their fruits at their orchards, or at the nearest shipping point. In order to get their just share of the proceeds they must be interested until the fruit almost reaches the door of the consumer. How is this to be brought about? It would be better to make an effort to combine the fruit companies, or divide the territory. One thing, however, is manifest, and that is, if the fruit growers expect to get their just proportion of the proceeds, have their fruits in every possible market, and in proper quantities, they must be united and manage the business themselves.

GOVERNOR R. W. WATERMAN'S REMARKS.

In introducing Governor Waterman, the President stated that this was the first occasion upon which this Convention had been honored by the presence of the Chief Executive of the State in discussing the fruit problem.

The Governor made a few remarks congratulating the Board on its work, and the fruit growers upon the interest they manifested in their chosen occupation.

Our efforts must be to improve upon our methods of cultivation, irrigation, and varieties of fruits, and concentration in marketing and shipping.

REMARKS OF MAYOR H. T. HAZARD.

THE PRESIDENT: I have the further pleasure to introduce to you the Mayor of the City of Los Angeles.

MR. HAZARD: Mr. President, and Ladies and Gentlemen: It is a peculiar pleasure to me to welcome to the City of Los Angeles a body representing, as you do, the fruit-growing interests of our State. It marks a new era in the prosperity and growth of our State. I take pleasure in welcoming you to Los Angeles and Southern California, because we look to you as the representatives that should bring, in connection with the cultivation of the soil, intelligence, learning, wisdom, and experience, and it is with pleasure that I listened to the address of your distinguished President, showing that while we have men who can cultivate our soil, we have knowledge that looks abroad for information and experience. And when we bring to our aid the experience of mankind in different parts of the world, I believe that Southern California will, in a few years, become the garden spot of the world.

Believing, then, that you represent the true interests of our State, I am proud and glad to welcome you to Los Angeles. I hope that your stay will be pleasant, and in years to come, if you see fit (and you will always be welcome) to be again with us, we will be glad to meet you. Hoping that God may speed you in your good work, we say go on. Thanking you, and hoping you will have a pleasant stay, I bid you good day. [Applause.]

ADDRESS OF WELCOME.

THE PRESIDENT: The fruit growers of Los Angeles and surrounding districts have selected one of their fellow citizens to deliver the address of welcome, the usual course that has been adopted at all the preceding Conventions. I take pleasure in introducing to you Dr. O. H. Conger, of Pasadena.

DR. CONGER: Mr. President, Ladies and Gentlemen: It is always a pleasing duty to stand as the representative of, or participant with, a self-devoted people to a great principle or cause, and upon this occasion it is especially gratifying to welcome so large and distinguished a delegation of representative horticulturists from abroad to the hospitalities of all Southern California. To you we extend a hearty greeting and warm welcome.

Again we meet to do honor to this largely augmented industry since the last annual assemblage. We meet also in the direct and indirect interest, not only of the intelligent horticulturist of the land of the orange and the vine, but in the interest of mankind at large.

No bounds can define the limits of thought or the generous offerings from the great storehouse of knowledge accumulated during the decades of struggle, successes, and failures in pursuit of the oft perplexing and

diversified horticultural industries of our coast. The zones of peculiar environment are being more clearly and legibly marked throughout the entire Pacific Slope, and a better understanding also of this vital question is near.

A quarter of a century ago we were famous for our exceptional and boundless mineral resources, and long ago explorers had searched the nooks and corners of our rugged mountain fastnesses in pursuit of Nature's unseen and unknown golden treasures, exciting the cupidity and envy of the monetary centers of the commercial world by the revelations thus obtained.

To-day our ambition has changed, and we convene not under a tent or the broad sheltering arms of the majestic pines of the Sierras, but here, in halls of grander proportion and enchanting beauty, as representatives of an advanced civilization, to celebrate anew an era of progress freighted with greater responsibilities and inspired with even grander achievements in the life history of our beloved State—a worship consecrated to the shrine of Pomona.

The growing effort to harness the subtle forces of Nature to do our bidding in the upper realm of plant life, taxes to the utmost the research, skill, and practical application of the principles involved in technical science.

Alchemy of old, and chemistry of to-day, reveals to the student of Nature and human understanding the wondrous beauty everywhere wrought throughout the known universe by that great, primal, exacting, and inviolable law of chemical affinity. Neither sunlight, heat, nor moisture can evade implicit obedience and refuse to shed their benign influence to sustain and perpetuate organic life. If, therefore, the horticulturist seeks a mountain home and consigns to these soils, at increased altitudes, the seeds, the tubers, and the various fruit trees of the valleys below, although warmed into life by the same rays and moistened by the same dews or rains that flow from the higher to the lower levels, those germs locked up and lying dormant in these organic forms of life will awaken and manifest functions, when springing forth obedient to inherent law, varying in a more marked degree than were the efforts of these dormant life germs aroused from their slumber at the lower levels of their former home. Environment works wonders, as chemical affinity, to which all forms and conditions of life are due, is called into active service only to comply with conditions under the law of correspondence.

If a soil is wanting in lime, iron, or organic matter, and the product sought requires one or all of the foregoing constituents, it is plain to the reasoning mind that this deficiency must be supplied to secure remunerative returns.

We have all observed, undoubtedly, that the apple, pear, or peach grown upon the mountain side clothes itself in raiment of rarer beauty and drinks in and stores up from the purer atmosphere more delicate and delicious qualities than seems possible from the grain soils and loaded atmospheres of the river valleys. And is it not a matter of record already that a discriminating public taste gives preference to the upland fruits and vegetables?

The successful horticulturist, as a rule, exemplifies a familiarity, more or less, with the chemistry of plant life, and when it shall become more general, it will be observed to have a greater practical value; and then

our river bottoms will very generally be given over to the coarser products—those requiring less exacting environment for the best results. Then, also, will the mountain sides swarm with a happier race embowered in groves of golden fruit and trailing vines, immeasurably broadening our area thereby for the production of the nobler and rarer fruits of the soil.

We often regard with wonder and admiration the comparative exactness with which our physical maps are traversed by isothermals through all degrees of latitude, meridian, and altitude, as well as defining the approximate limits of various diseases to which human kind are liable, and yet the horticulturist may be to a degree skeptical in establishing quite as exact limits to the fruit isothermals throughout the length and breadth of California. But this will scarcely disturb our equanimity, however, for as yet we are laboring under the ban of an experimental age; floundering in an open and angry sea of doubt and uncertainty, and it may be that our charts and past records will require revision, gauged by the more exact requirements demanded by science and philosophy.

Not a petal of the flower or blossom, not a blush upon the luscious peach or dainty berry, but what yields a willing obedience to exacting chemical formula; yet the novice may oftentimes seem unreasonably persistent in contending against these exacting conditions of science and law.

If asked, however, why his calf or colt, for instance, is so poor in flesh and stunted in growth, he instantly comprehends the situation, but fails to extend his narrow limits of vision, not realizing that the same general laws of chemical affinity bring together the elements of matter to form the flesh and evolve the aroma of all fruits that under varying functions perform equivalent offices in replacing the wasted tissues of all animal forms.

The crystal age, the plant age, and the animal age, define the grand divisions of matter, as also the tangible side of all expressions of organic life.

Within this grand trinity of Nature also circles and centers all inorganic and organic substance. The life principle and function inherent in, and running through all, is largely interchangeable, a coördination that necessitates a mutual dependence. Endowed as California is with the richest heritage from the hand of Nature, in treasures of fine metals, and soils plethoric with all possible unknown resources, under the guiding star of science and reason what may not be anticipated, even at this early day, for the toiling millions that are to crowd in upon us? With this reasonable prospect in the near future, should not both State and National Legislatures be constantly importuned to accord additional facilities, that the masses may receive the necessary instruction so as to thoroughly equip them with the practical knowledge requisite in the pursuit of all branches of horticulture under the variable conditions of environment? That will tend also to lessen the large holdings of wild and untamed acres susceptible of the highest culture known to art, thereby opening avenues to the incoming applicants, granting them the privilege of contributing to the State and National treasuries their just quota of the taxes.

The family now barely subsisting upon a five-acre tract, under a more favorable condition suggested by the better standards outwrought

through an intellectual activity, could avail themselves of accrued circumstances to materially mitigate the exigencies surrounding their life of toil, and thereby also greatly enlarge their circle of usefulness.

The law of demand and supply in plant life is inexorable, and starvation is no less readily observed on the foliage of the fruit tree than upon the form of an animal. The neglectful and indifferent fruit grower must, therefore, be held responsible, although the public are powerless and the neighbor outpowered to mitigate or retrieve the injury and loss thus sustained. The loss of fertilizers available by the slothful class would retrieve a fortune thus wasted. This is painfully observable upon every hand, and millions of money annually disappear from the aggregate sum by this wanton destruction of this invaluable plant food.

The sewage and other fertilizers of our cities, if properly utilized, would largely return the money drawn upon them for the fruits and vegetables consumed. These streams of perpetual and accumulating wealth are usually consigned to the maw of old ocean as food for the finny tribe, and forever lost to the world. Thus, history is permitted to repeat itself in this day of chemical science and general enlightment upon the elements and necessary constituents of plant food.

The chemical function of plant life in the inviolable economy of Nature is to transform and transmit noxious vapors and other organic substances. The waste, and all refuse thrown off in rebuilding and sustaining all organic forms, is so much elaborated plant food to be again resurrected and reincorporated that at each round in the order of Nature, of the life, death, and resurrection of the elements of matter, the reunion of these elements may gradually raise from the lower or less developed to the higher and more perfect forms of beauty and usefulness all plant life. Thus, in the natural order of things, supplemented by human art and wisdom, the wild fruits and flowers unfold to delight and compensate the searcher after the more pleasing and valuable.

Night soils, of all fertilizers, must stand at the head as of the greatest value, and every ton of the same thoughtlessly drained off to an irrecoverable destination becomes an irreparable loss to the aggregate wealth of the world. Economists regard all organic waste, whether of animal or plant, as one form of the evolution of matter, and also modern thought, as that lost form in the more tangible world of cause, decreed in the prophecy at the advent of a world of fire mist, and fulfilled in the recognition of a world of endless mutations and infinite possibilities.

It may remain as an undisputed proposition that it is as essentially necessary to recuperate enervation or vital energy in the soils or plant, as in the animal, and a precinct or State that fails to return an equivalent for that taken from producing soils—to restore that which has already been extracted and stored up in the grain, the fruit, or vegetable—will as certainly bankrupt such soils in a comparatively brief period, as the banker who suffers drafts upon his institution to exceed the deposits.

To reach the highest degree of economy and excellence in horticultural pursuits, ideal standards may be sought by a series of experiments; and when attained, a record of the methods employed should form the basis of a practical application upon a more extended scale. By such methods, not only could standards be raised, but bank accounts also largely augmented. Anticipating the accretion of our present population, by natural and other causes, to a hundred millions or more within the

limits of the national area during the nineteenth century, what more urgent necessity could be suggested to adopt better methods than to pursue a policy looking to a speedy reduction of the now large holdings of land to the minimum in acreage, as the basis of a subsistence by occupancy of families, large or small.

Thoroughness is the watchword of the hour, and those who heed the admonition will duly attain to a greater degree of material prosperity, a fund of most useful knowledge, as well as surround themselves with conditions more pleasing and attractions envied by the less thrifty, stimulating a passion also in others to excel, thereby becoming double benefactors to the world.

Fearing, however, that the time alloted to this portion of the exercises has already been exceeded, although the propositions announced have received but brief mention, I trust that the discussions that are to follow, of all important horticultural questions, will merit a more extended consideration at the hands of so distinguished a delegation of representative horticulturists now here assembled from all parts of the State.

Admonished, therefore, of the labor before this Convention, and the value of time, in closing I beg simply to assure my neighbors of the southern citrus belt, that from the vine-clad slopes of Shasta's snowy zone to bustling San Diego, there are thousands of "sly little nooks along the babbling brook," as well as broad acres yet unknown, waiting patiently for the touch of knowledge and skill to ultimately startle the more conservative and cautious with thundering train loads of the golden apples of Hesperides, to further add to the joys and common blessings bestowed upon mankind; and with this conviction in the ascendant, and also as an honored participant in these deliberations upon this auspicious and happy occasion, it affords me renewed pleasure on behalf of all the people of this portion of the Golden State, and more especially those of the Queen City, to again extend to you all, not only the right hand of fellowship, but also a most hearty welcome to a generous hospitality during your sojourn in our midst.

VOTE OF THANKS.

MR. A. BLOCK, Santa Clara: I move that a vote of thanks be extended to the Chief Executive of the State, for the interest he has shown and taken in horticulture and for his presence with us.

THE PRESIDENT: In putting that motion I will ask that the Convention show their appreciation of the presence of the Governor at this meeting by a rising vote.

The motion was unanimously carried.

A vote of thanks was likewise given to Mayor Hazard and Dr. O. H. Conger for their presence and addresses.

AFTERNOON SESSION.

(President Ellwood Cooper in the chair.)

INSECT PESTS AND LAWS THEREFOR.

Essay by W. E. Collins, Ontario.

There is no branch of the horticulturist's work that demands so much of his careful and studious attention as does this. Having decided upon the class of fruit he wishes to depend most largely upon for profit, and selected his land with that end in view, he can enlist the advice of trustworthy, experienced friends and responsible nurserymen as to the particular varieties to be planted. He may even closely observe and follow their methods of pruning and cultivation, and be reasonably sure of profitable returns in due time. But in his fight with insect pests he will encounter difficulties not presented by any other branch of the work, and with which he must reckon and wrestle largely unaided. It can be no longer doubted, I think, that the various kinds of insects are more prolific and more tenacious of life in some localities than in others. As a consequence, each locality must conduct its own experiments in order to determine the most successful remedies to be employed for their extermination. Seasons differ from the preceding or succeeding ones. The rainfall is more or less copious; winds more or less violent, and differ in prevailing direction and character. Hence, these experiments, to be of value for after reference, must be conducted in a careful and systematic manner. A careful record should be made at the time of application, of the date, time of day, fog, clouds, rain, altitude, temperature, humidity, direction and character of winds, not only at the time, but for two or three days preceding and following; mode of preparation and quantity used. It is probably within the knowledge of every one present that a remedy successfully used by one has utterly failed in the hands of a neighbor. Such failures are far too common, and I attribute them largely to an imperfect preparation, a careless application, a neglect in observing some or all of the conditions just mentioned, or a disregard of the knowledge gained therefrom.

"In union there is strength," so coöperation in dealing with this question is just as important and will be as productive of good results as in the marketing of our fruit or in any other aim which such means may be lawfully employed to accomplish. The industries of this State are as varied as they are becoming important, and taken together form one grand aggregate, which compares favorably with many of the older States. In that particular one which we represent, and are here convened to discuss, it ranks with the foremost, and the growth which horticulture has made here the past ten years will be eclipsed by the phenomenal strides it will make the next five. Mining, agriculture, and various other industries have gone to the Legislature and asked for and obtained the legislation which they deemed necessary to enable them to conduct their ever expanding operations to the best advantage. The fortress has also been stormed in our behalf, and with good results. Since the first Act respecting insect pests was passed in 1880, we have had progressive legislation, and last session gave us the best yet, largely through the indefatigable efforts of the Secretary, Mr. Lelong, and Mr.

E. W. Holmes, representative of San Bernardino County. But we need more yet, and by coöperation we can get it. In our county, our Horticultural Board compiled statistics from which they were able to show the Supervisors that the fruit interests represented 71 per cent of the total assessment for that county, or 91 per cent, excluding railroad property. Many of the fruit-producing counties can do the same thing. And every one can show that it is entitled to the fostering care of the Legislature and the County Supervisors. I am sorry to learn that in a few counties these latter officials are so indifferent or obstinate, that they refuse their support to the Commission which they have created. Let such be relegated to their narrow spheres, and more enlightened men installed in their stead. Now, if we can substantiate these claims of importance, we are assuredly entitled to have our petitions heard and carefully considered by the Legislature. Let us see to it next fall that our representatives are men heartily in accord with this sentiment, and we shall have taken one great step in advance.

Each Act placed on the statute books evidences the fact that the intention of the Legislature has been to provide machinery whereby we might control this insect question. In 1883 the State Board of Horticulture was called into existence by a Legislature which did not forget to add that its members should practically serve without compensation. All praise to the worthy men who have paid their $5 for their commissions to serve their unappreciative fellows in a thankless, emolumentless office. We are to-day enjoying the beneficial results of their love-given labors, and no true horticulturist will deny the fullest meed we can bestow in return for their great sacrifices of time and convenience. But their territorial jurisdiction is so extensive, the conditions so dissimilar, that at best their work must partake largely of a directorial character, a kind of paternity as it were. The changes in its organic law, which were made in 1889, clearly reveal the point which I desire to emphasize, *i. e.*, that we must rely on our County Boards for effective work, always presupposing that they are constituted of intelligent, conservative men, acting in harmony with the State Board.

The Act of 1889 made it mandatory on the Supervisors to appoint a Horticultural Commission, on the presentation of a petition properly signed. In order that the object of the petition and the will of the people may not be defeated by parsimonious or obstinate Supervisors, the fifth section of this Act should be amended so as to make the compensation of the Commissioners not less than $3 per day and expenses, and of Inspectors not less than $2 50 per day, of actual service in each case. As it now stands the Supervisors may negative their action by allowing a nominal compensation. It can be safely intrusted to them not to fix it too high. We want intelligent, progressive, active men as Commissioners. If they are even aggressive it will not hurt any one, so long as they are not impolitic nor offensive. But a fair compensation should be paid, not only to Commissioners, but to local Inspectors as well, so that the best men may be induced to serve.

But it is in the matter of quarantine regulations that we need and must have more positive legislation. I am not sure but I was mistaken when I stated our legislation had been progressive. In reference to County Boards it has been, but in some other respects it has not. The vital weakness of all of it is that it relies upon disinfection as a sufficient protection against the spread of insects and diseases. The

experience of the past fifteen years has proved this a fallacy. We have sprayed and dipped and disinfected by various processes, still the scale bugs have journeyed far and near in blissful ignorance of the long and short haul clause.

Now, I expect I shall tread on the toes of the nurserymen, but they must not be too sensitive. It should be borne in mind it is the recalcitrants we are after. Every honest man among them will admit that the nurseries are, to a large extent, responsible for the spread of insects. Who among them, if he were setting out a young orchard, would not prefer to purchase his trees from a nursery in which or its surroundings these enemies could not be found? Then common honesty should deter him from offering for sale what he would not plant himself. The older fruit-growing communities I expect to demur to some extent, but they should not so soon forget the struggle for existence they have had, but join in the effort to endeavor to spare the younger communities a repetition of their experience. Where orchards and nurseries alike are infested the necessities of quarantine are not so apparent; but to those sections in which horticulture is in its infancy, where an increasing interest is being taken in it, and farms are being rapidly changed into orchards, or virgin soil under the magic influence of water is made to blossom and produce wealth for its owners, it is of the most vital importance that they should have the undoubted power to protect themselves against the reckless distribution of trees from pest-ridden districts. Where we find *Icerya purchasi* in the soil in boxes containing shrubs and plants; where we find *Aspidiotus perniciosus* plastered over the deciduous trees offered for sale, and in many cases actually shipped and delivered; where we find live *Aspidiotus aurantii* on green pears offered for sale by grocers and hucksters sixty miles or more from where they were grown, is it not time to pause and consider whether the means of protection we have been relying upon are not inadequate? When such conditions exist is it not wise to seek some other means to put a stop to this pernicious recklessness that threatens to overwhelm the profits of this whole industry? Mr. President, I live in a community where but one sentiment prevails on this question. They had rather deprive themselves than receive from any quarter that which would, if it gained a foothold, threaten extinction of what they have. By unanimity of sentiment and coöperation of effort they have succeeded thus far in keeping themselves to a very great extent free from danger, and in a single decade have risen from nothing to an export fruit trade this year of not far from $3,000,000; and this is only the beginning. I am convinced unless we coöperate in a more comprehensive manner than as yet, to put into force the laws we now have, and ask the Legislature for more clearly defined quarantine powers, our efforts to overcome these fruit pests must prove abortive.

A careful study of the legislation on insect pests shows it has clearly been the intention of the Legislature to give extensive quarantine powers. In every Act relating to the State Board or the organization and powers of County Boards, quarantine is mentioned as among their duties, but they fail to define in what manner it shall be executed. In that of 1889 relating to County Boards, it is made their duty to report to the State Board "what is being done as to quarantine against insect pests and diseases." But no mention of any power to quarantine is made.

In the Act of 1889 relating to the State Board, Section 6 provides for

a quarantine officer "who shall have power to enforce all rules and regulations (made by the Board) regarding the spread of insect pests, *quarantining districts or nurseries* found to be infected," but not a word as to how quarantine is to be effected. In both of these Acts there is only an inferential intention on the part of the Legislature to confer quarantine powers. They stopped short of a clear declaration.

In Section 6 of the Act of 1883 creating the State Board, we find these powers clearly and well defined. It was there made mandatory on the Board, on the report of the State Inspector or other well attested facts, to declare infested districts under quarantine and subject to the rules and regulations of the Board in that behalf. But here again the Act failed, for in the powers enumerated to make rules and regulations for various purposes, *quarantine* is carefully omitted. Nowhere in all the other Acts on this subject is there a well digested plan of quarantine, accompanied by specific authority to enforce it, except in the Act of 1881, defining and enlarging the duties and powers of the Board of State Viticultural Commissioners, under which the State Board of Horticultural Commissioners were first organized. Sections 3 and 4 of this Act so nearly meet my views that I would like to encroach on your time long enough to read them. A careful perusal of the rules and regulations promulgated under this Act by the Viticultural and Horticultural Boards of the State, will prove to be time well spent. So, Mr. President, our legislation on this branch is, to say the least, vague. In the case of contagious diseases among men and animals, isolation and destruction of the affected ones is authorized by law. Is the fruit interest of the State of less importance than that of stock raising? True the higher order of life is not involved; the ravages of insect pests may not be compared to pleuro-pneumonia, smallpox, cholera, or even la grippe; but because they are not epidemical, they are none the less destructive of material interests. Fatality surely follows in their wake.

At first thought it may seem dangerous to intrust the power to control this matter into the hands of a county Board, but on sober, second thought, I think there should be no hesitation. County Boards are in closer touch with the people. They are neighbors, and naturally there is a community of sentiment and interest that does not exist where the official representative is governed by a distant authority. If an epidemic break out among human beings the county health officer assumes control; among stock, the animals are slaughtered by the same authority; if among bees, even they are not spared by the same authority. If the health of a community is endangered by the disregard of sanitary regulations or laws, the health officer of the county steps in with his restraining authority. If the officer exceed his authority, or allow a personal animosity to influence his acts, no one would question the wisdom of the law, but rather demand his removal. So the county is unquestionably the best and safest charge into which quarantine can be committed. Already, under the County Government Act of 1889, the Supervisors have been given powers to pass ordinances for the extermination of insect pests. Under the general powers conferred by that Act, good legal authorities give it as their opinion that Supervisors can pass ordinances absolutely quarantining infested districts. But we want a clear cut authority. The Legislature should not force us to go to the Supreme Court to learn our powers.

It has been suggested, if this power be exercised by counties, it will

result in retaliation by other counties, which would be injurious to the fruit grower. Not at all. Let them retaliate; that is their undoubted right, provided a correct spirit actuate it. We shall then have the strongest allies in nurserymen whose nurseries and districts are free from infection, because the most potent factor, that of self-interest, will move him to see not only that they are kept so, but that the neighboring orchardists do not jeopardize his prospects by allowing their places to become infested, or by introducing any suspicious stock into the locality.

It is always much easier to criticise than to prescribe a remedy; hence, if you ask what relief I have to suggest by way of legislation, I am at a loss how to best answer. But I think I can point out two or three ways whereby some improvement may be made. The Act of 1885, "to prevent the spreading of fruit and fruit tree pests, and to provide for their extirpation," is very good, and should be left to apply where County Boards are not organized. And in order that such portions may have the benefit of quarantine, I would amend the Act of 1889, relating to the State Board, which appears on the statute book as an amendment to the Acts of 1883 and 1885, but in fact supersedes them, so far as the sections enumerated are concerned, by reënacting that portion of Section 6 of the Act of 1883, relating to quarantine, and which is omitted in the later Act. This would efficiently protect those counties wherein the opposing elements, of whatever nature, were powerful enough to prevent the appointment of a County Board, or where the fruit industries had not yet gained sufficient headway to have their interests recognized at the hands of the Supervisors.

Now, as to the County Boards, there are two ways by which the power of quarantine may be had:

First—To add a section to the Act of 1889 something similar to what I have just suggested for the State Board; or,

Second—To give the Supervisors clearly the power to pass ordinances in that behalf.

In the County Government Act of 1889 are three clauses which would seem to convey that power now:

Section 25, defining the powers of Supervisors. Subdivision, Section 28, reads: "To provide for the destruction of gophers, squirrels, other wild animals, noxious weeds, and insects injurious to fruit, or fruit trees, or vines, or vegetables, or plant life."

Subdivision, Section 33, reads: "To make and enforce, within the limits of their counties, all such local, police, sanitary, and other regulations, as are not in conflict with general laws."

Subdivision, Section 35, is as follows: "To do and perform all other acts and things required by law not in this Act enumerated, or which may be necessary to the full discharge of the duties of the legislative authority of county government."

By the addition to subdivision, Section 28, of the words "or to quarantine against districts or places infested with such insects," I think the desired authority would be had.

THE CODLIN MOTH, AND REMEDIES THEREFOR.

Essay by C. W. REED, Sacramento.

The codlin moth (*Carpocapsa pomonella*), or apple worm, originally came from Europe, and is believed to have reached California through fruit sent from the East for exhibition at our State Fair, about the year 1872.

Downing says: "The perfect insect is a small moth, the forewing gray, with a large round brown spot on the hinder margin." These moths appear in California the latter part of April, and early in May deposit their eggs mostly in the blossom end of all kinds of apples and pears. In a short time these eggs hatch, and the worm burrow in the fruit until it reaches the core, causing the fruit to ripen prematurely and drop to the ground. The worm when matured leaves the fruit and crawls up the body of the tree into crevices of the bark or crotches of the tree, and spins its cocoon. The moth in California soon hatches again, coming from its cocoon in the winged state, whence they seek their breeding ground—the fruit—and deposit their crop of eggs. Three generations will develop in some portions of California in one season, and the increase is so rapid that with late varieties of apples and pears hardly a sound specimen can be obtained if nothing is done to check its depredations.

There are many remedies for this fruit pest, all having more or less merit. Any means that will destroy the insect or the larva is desirable. Scraping off the rough bark and putting on bands of cheap straw paper, or old sacks, will make a trap by which thousands of the larva can be destroyed by examining these hiding places every week or ten days.

Some ingenious devices have been invented, made of wire, which allows the small worm to enter, but prevents his coming out after being developed into a moth.

The most satisfactory remedy that I have found to use is Paris green—one pound dissolved with ammonia to one hundred and sixty gallons of water, and sprayed on the fruit with an ordinary spray pump as soon as the blossoms drop, and again in about ten days. The mixture must be kept thoroughly stirred while being used, otherwise it will become concentrated and burn the leaves.

I have saved 90 per cent of a crop of pears by the use of Paris green, when at least 90 per cent of the crop the year previous were wormy. Swine, although they are troublesome animals in an orchard, do good work in destroying the codlin moth by eating the fruit that drops prematurely from the trees.

Growers will be well paid to use any practicable method in the most thorough manner for destroying this most destructive of all pests of the apple and pear.

PREDACEOUS INSECTS.

Essay by ALEXANDER CRAW, Los Angeles.

The subject of parasitic insects has been so well discussed at the semi-annual meetings of your honorable Board, and printed in your annual reports, that it would be simply a waste of your valuable time to attempt to add to your knowledge in this very important study.

I have written several articles for the local press upon predaceous and internal insect parasites, but since then scale insects that threatened the very existence of the fruit industry have been almost exterminated by Nature's remedy, thus showing that we are working in the right direction by introducing and assisting in the propagation and distribution of our insect allies. It would pay the State of California to have an experienced entomologist—one that would not have to wait for the slow process of red tape of our general Government, but could be dispatched by your Board whenever required. To show the force of this I have but to call your attention to the great good resulting from Mr. Albert Koebele's visit to Australia, and the successful introduction of the Vedalia. Had this been done when first brought to the attention of fruit growers, how many valuable orange groves could have been saved from destruction, the value of one acre of which would have more than paid the whole cost of the importation of the Australian ladybug.

I am pleased to report that the San Gabriel red scale in the neighborhood of Sierra Madre is fast disappearing by the attack of a small chalcid parasite. The cottony grape scale (*Pulvinaria innumerabilis*), the mealy bug (*Dactylopius*), and the soft scale (*Lecanium hesperidum*), all of which in their day caused considerable injury, have been almost exterminated by parasites.

The only new internal parasite I have to report is a *Tachina fly* that preys upon the spotted squash bug (*Diabrotica soror*). I called the attention of Professor Coquillett to it; he has bred the fly to the perfect state. He found it to be a new genus, and has written a scientific description of it, and named it after me, but I hope this will not impair its usefulness, as the last season over 30 per cent of this destructive beetle were destroyed by it.

RISE AND DOWNFALL OF THE COTTONY CUSHION SCALE.

Essay by George Rice, Alhambra.

But for the timely arrest and practical extermination of the cottony cushion scale, the final results of its devastation would have been incalculable. The story of its destructiveness is too fresh in the minds of all to be repeated at this time.

The damage caused by its ravages amounted to millions of dollars, and the wisest heads predicted that unless some sure cure or preventive should be secured, the time was not far distant when our beautiful and fruitful orchards would become barley fields, and the old time business of pasturing the lands with sheep and cattle would soon return.

Not only this wholesale destruction of our orchards, but the desolation of the beautiful yards, gardens, and parks, for which California is so famous, would follow; but let us not contemplate what might have been, but congratulate ourselves on the present happy condition of our homes, surrounded with the orange, lemon, vine, shrubs, and roses, and, in our congratulations, let us not forget the gratitude we owe to those who, by their persistent endeavors, by their trained and scientific knowledge, made it possible for us to-day to say, "This curse has passed by and we are thankful."

It may be of interest to many to read a very brief history of the rise and downfall of this worst of pests, the cottony cushion scale. Besides, it is well to record some of its history while it is fresh in our minds, and if any mistakes are made they can be corrected.

The cottony cushion scale (*Icerya purchasi*) undoubtedly originated in the acacia forests of Australia, where it seems to make its home. The first authentic date I can find in its history is 1873, when it was noticed in Cape Town, Africa. No date is to be found of its advent in Australia, but that it is indigenous to that country there is no doubt; however, it is only in late years that it has extended to their orange, lemon, and ornamental trees, shrubs, vines, and roses. That it has not received the attention in Australia which it has in this country is evident from the fact that over there they did not know what was killing the scale in some sections, while in other sections, and in New Zealand, the pest has full sway. The papers of those infested sections (papers received on last steamer) recommend the use of several of our old washes to control or exterminate the scale. They will probably hear of the Vedalia later on, and we will take pleasure in sending them a large consignment at almost any time.

The cottony cushion scale was brought to this country from Australia in 1868 or 1869, on trees and shrubs imported from that country. Attention was first called to it by Mr. R. H. Stretcher, of San Francisco, in a paper, accompanied with specimens, which were probably very much admired, which he read before the California Academy of Science.

In 1872 Prof. C. V. Riley, then State Entomologist of Missouri, had his attention called to this scale.

It was not until 1877, thirteen years ago, or five years after Professor Riley had his attention called to it, that the Entomological Department of the Department of Agriculture at Washington was informed of this pest. Professor Riley, in the introduction of his report as Entomologist for the Department the following year (1878), "refers to the serious complaints that came from the Pacific Coast, of injury by it (the cottony cushion scale) to orchards and ornamental trees." It was then in its incipiency, but was found to be a dangerous pest; yet if radical and heroic treatment had been used at that time it might have been stamped out. However, it is easy enough now to see what might have been done, but it should be a lesson to us in the future.

The spread of the scale was hardly noticed at first, but it soon began to increase very rapidly and caused much alarm. From Menlo Park it spread over Central California, reaching San Mateo, Sacramento, Santa Rosa, San Rafael, and many other places.

It was introduced into Los Angeles in 1878, and in Santa Barbara that same year, on trees received from Menlo Park, about ten years after its first introduction into the State. In the southern part of the State the scale found a congenial home in the mild climate, among the orange groves, and thrived and multiplied and set out on its work of devastation, which soon proved to be worse than if a destructive fire had swept over the country. It was three years after its introduction in Los Angeles before it put in appearance in the beautiful San Gabriel Valley, where it was taken on a potted plant. From the city and the valley it soon spread over hundreds of acres of orchards and gardens in Los Angeles County, and it seemed as if citrus culture was doomed.

THE DOWNFALL.

An era of soaps, caustic, kerosene, and poisons, made up into a thousand and one different cure-alls, ensued; in fact, almost every orchardist had a so called remedy of his own, most all of which really did more harm than good, but "the good time coming, long on the way," was when her ladyship, the Australian ladybug (*Vedalia cardinalis*) came to our rescue.

It was Mr. Alexander Craw, who, as early as 1880, first suggested that there *must* be a parasite where this terrible scale came from in Australia, to keep it in check, else the groves of that country would have been destroyed.

In 1881 we find recorded in the proceedings of the State Board of Horticulture a discussion by its members on the subject of securing and propagating parasites and beneficial insects. Mr. Felix Gillett, one of its members, advocated the propagation and importation of parasites. The Board fully recognizing the importance of the subject, kept persistently at work to secure a parasite for the cottony cushion scale. They petitioned the Department of Agriculture, memorialized Congress, passed resolutions at each and every Fruit Growers' Convention, corresponded with officials and orchardists in all parts of the world, and kept up the fight until their efforts were rewarded with success.

I know I tread on disputed ground as to whom credit is due in securing the Vedalia, and, through it, destroying the worst of all our pests, the cottony cushion scale. But, in writing its history in this brief paper, I intend only to give the facts as I find them.

Alexander Craw says over his own signature: "The facts are, Professor Riley visited Southern California in March, 1887, and called at the Wolfskill orange grove. After discussing the white scale question he advocated his expensive coal oil emulsion, and I our fumigator. I also said that the only hope I saw of any relief would be to send Professor Coquillett to Australia to study up what natural enemies were keeping the white scale in check there, and import them to California. He (Riley) opposed it. He was so emphatic in his opposition that I was very much surprised to see in the 'Riverside Press,' a week later, that he advocated, in an address before the State Board of Horticulture, the advisability of sending an agent, as I had suggested to him."

All efforts to secure help from the Department of Agriculture, Washington, failed, because the department was not authorized to spend the money, appropriated for that department, to send a man to Australia, *even* after we had positive information that there was a parasite waiting for us, that would, at least, check the ravages of the cottony cushion scale, if we would only go and get it.

All efforts to secure an appropriation from Congress failed, in not providing in the appropriation that was allowed that it could be used in sending a man outside of the United States. Thus the case stood late in 1887. Congress had, however, provided amply for an exhibit to be held in Melbourne in 1888, appointing the Hon. Frank McCoppin, of California, as Commissioner. Here was an opportunity, and it was improved. Knowing that Mr. J. DeBarth Shorb, of San Gabriel, who is the owner of large orange orchards which were badly infested with the cottony cushion scale, had interested himself in the matter, I wrote him as to how it came about, etc.

HOW IT CAME ABOUT.

The following letter explains itself, and is given in full:

SAN GABRIEL, CALIFORNIA, February 23, 1890.

Mr. GEO. RICE:

DEAR SIR: Your favor of the nineteenth instant, asking for the history of how the *Vedalia cardinalis* was introduced into this State, is received. I have the honor to state, in answer thereto: That one evening, some time previous to the departure of Hon. Frank McCoppin for Melbourne, he asked me how or what he could do as Commissioner, that would most benefit his State, California. Knowing, for some time past, through the Australian newspapers, as well as by private sources of information, that a parasite had destroyed all the cottony cushion scale in and around Adelaide, within a circuit of one hundred and twenty-five miles, I told Mr. McCoppin if he could secure the appointment of some entomologist of the Agricultural Department of Washington, to be sent on with him to secure the parasite and provide means of sending them here without dying on the steamer, he would do a grand work for his State. Immediately acting on the suggestion, he telegraphed on to Secretary Bayard, using my name, as he told me, as authority for the value of the parasite, and asking for the appointment of the entomologist.

Mr. Bayard replied, expressing his willingness to make the appointment, but regretted that there was no appropriation available to meet the necessary expenses.

Mr. McCoppin, replying, offered, very generously, to devote two thousand ($2,000) dollars of the appropriation made to meet the expenses of the United States Commission to Melbourne (and which was entirely under his control), and the entomologist was duly sent and did his work admirably. The *Vedalia cardinalis* arrived in good condition, were placed in careful hands, and by the same generally distributed throughout the State, with the result now known far and wide. The cottony cushion scale is a thing of the past.

I desire to publicly express my thanks to Mr. McCoppin for his generous and efficient act in obtaining for the orange growers of California this great blessing, the *Vedalia cardinalis*. Without its aid the entire citrus interest of California was doomed to destruction, a loss greater than generally appreciated throughout the State.

I also desire to call attention to the fact, that Mr. McCoppin's only desire was to serve his State in accomplishing the work he did, and that he did not consider himself in the matter.

Could I, with propriety, in a public inquiry like this, withhold my name entirely from connection with it, I would do so, and not attempt to share the credit when it belongs to Mr. McCoppin.

Very truly yours,

J. DEBARTH SHORB.

We find in the official records at Washington, that Mr. McCoppin had done as suggested in the above correspondence.

Mr. G. L. Rives, Assistant Secretary of State, communicated the facts to the Hon. N. J. Coleman, Commissioner of Agriculture, "requesting him to detail Professor Riley and his assistants to be sent to Australia at the expense of the Commission." In reply to this communication, Mr. Coleman, on June twenty-third, said:

There can be no question as to the importance of the investigation alluded to, and I know of nothing to prevent my complying with the proviso that the party or parties I may send to do the work will go as an aid or aids to the Commission, and make a report which shall be part of the general report to the Secretary of State.

Three days later, June twenty-sixth, Secretary Rives, in a communication to Commissioner Coleman, says:

I have to inform you that the matter of employing and compensating subordinate assistants has been left entirely to the discretion of Mr. McCoppin, subject, of course, to the eventual control of the Secretary of State. In the present instance the Department approves of Mr. McCoppin's arrangements. In brief, the gentlemen whom you propose to send, so far as they represent the United States in any capacity at the Melbourne Exposition, will be entirely under the direction and control of Mr. McCoppin, who will audit and pay all their accounts, and to whom they will report.

This, it would seem, should settle the question as to how the money, the most necessary part of the accomplishment of the end, was provided, unless we give the preponderance of credit to the keen-sighted and

trained entomologist, Mr. Albert Koebele. That Mr. McCoppin opened the way to secure the final result, and that to him the honor belongs of finally reporting to the general Government the discovery and importation of this most wonderful little ladybird, the *Vedalia cardinalis*, is a settled fact.

THE FINAL RESULT.

We had heard that there was a parasite in Australia that had almost entirely exterminated the cottony cushion scale, and it was to get these parasites that Mr. Koebele was sent to Australia. The parasite was known as the *Lestophones*, a minute fly that punctured the scale, laid its egg, which hatched out into a grub that made its meal of the scale, changed into a fly, to again repeat its work.

Mr. Albert Koebele left San Francisco for Australia August 20, 1888, and arrived at his destination in due season. He immediately sent a supply of the Lestophones to this country, which were duly taken care of on their arrival. In the meantime Mr. Koebele went to work to thoroughly investigate the scales, their parasites, and their workings, and was not long in discovering what our Australian friends *had not* done, that the "boss" scale destroyer was an entirely different kind of a parasite. It was the ladybird, the *Vedalia cardinalis*, he found to be the principal enemy of the cottony cushion scale, and he was not long in dropping Mr. Fly and making the acquaintance of her ladyship, Miss Vedalia cardinalis. He captured and shipped several colonies of beetles and their larvæ. The first importation reached here November 30, another December 29, 1888, and still another January 24, 1889. These colonies were sent to the Wolfskill orchard, in Los Angeles, and Dobbins' and Chapman's orchards, at San Gabriel, under the care of Professor D. W. Coquillett, of the Entomological Staff, Department of Agriculture. They soon multiplied and increased something after the form of a geometrical progression. Mr. Wolfskill and his foreman, Mr. Alexander Craw, who knew all the time "that there must be such an enemy in Australia," together with Professor Coquillett, distributed thousands to the anxious orchardists, who, hearing of their wonderful work, flocked in to get them. The same work was going on at the ranch of Colonel J. R. Dobbins, at San Gabriel, where the Colonel and his help gave their entire time to making up and distributing colonies to all who came for them, and they came from far and near.

While the good work of the Vedalia was going on in Southern California, the little ladybug was distributed by the State Board of Horticulture throughout Central and Northern California, wherever an orchard, garden, or shrub was known to be infected with cottony cushion scale.

By December 1, 1889, the work of exterminating the cottony cushion scale was practically accomplished. The money value of this Vedalia to the orange growers of this State has been incalculable. The saving of the orchards already infested, the protecting of the others that were sure to be blighted by this terrible curse, to say nothing of perpetuating an industry that it seems will be the king of all our horticultural pursuits, is simply grand, and cannot be estimated in the usual dollar and cent test.

WOOLLY APHIS.

Essay by E. A. Rogers, Santa Rosa.

The woolly aphis (*Schizoneura lanigera*), or apple blight, is a dreadful enemy of the apple. It makes its appearance on the cuts and bruises of trees in the form of a white down, which is composed of a great number of very minute woolly lice, that if allowed to remain, will increase with fearful rapidity, and produce a sickly and diseased state of the tree. Its home is also underground on the roots, which makes it hard to exterminate.

I fully agree with Luther Burbank, of Santa Rosa, that this pest is carried from place to place by the wind. A few years ago I planted some apple seeds; the next season I took them up and grafted them; the next season I took them to plant and sell, and to my dismay found them badly infected with the woolly aphis. There was an old orchard less than half a mile away, infested with the same.

They are most numerous on the Lady apple variety.

The Northern Spy is proof against them.

Luther Burbank has had the above roots sent him from New Zealand (where the woolly aphis is supposed to be most destructive). He grew and grafted them, and knows them to be proof against this pest.

REMEDIES.

During the summer months those on the body and limbs of the tree can easily be killed by touching them with a swab dipped in coal oil. To destroy them on the roots, spread gas lime around the tree, from one to four shovelfuls to the tree, according to size; the lime must not come in contact with the body of the tree; to prevent them crawling down the tree, draw the dirt away from the body of the tree, fill in with ashes, then throw back the dirt; this should be done in the fall, before the rains.

We have a great many old orchards in Sonoma County, which are more or less affected with this pest; the owners say apples do not pay. Every few years they are cut back, consequently such orchards get but little attention and the woolly aphis has full sway.

RED SCALE (Aspidiotus Aurantii).

Essay by H. Hamilton, Orange.

The insect, when first born, is an ovoid yellow sack, to many eyes microscopic. It remains in that condition less than an hour, when antennæ and feet make their appearance, and locomotion begins. If it is on a citrus tree it is at home, and begins at once searching for a place to locate for future development. Its first choice for location is on the fruit; second, a leaf; third, a tender limb; and fourth, the body of the tree. When it finds a good place—which generally takes a day or two—it inserts its beak in the fruit, leaf, or limb, and begins to feed on the sap of the tree. It now begins to grow and secrete a wax for a covering or scale. We must give it the credit of being a clean insect. It secretes

none of the filth that comes from the white and black scales, and many other insects. It secretes only its own covering.

When this insect is fully developed—which requires two or three months—it is found to possess three skins, one ventral and two dorsal. The upper dorsal is transparent, the second is of a reddish brown, and gives it the name red scale. The body below the covering always retains the yellow color. The colored skin contains a center and two concentric rings. The outer one is open to allow space for the ovipositor. The male never becomes as large as the female, and is not round, but oblong, with exuviæ nearer the anterior end. The posterior end furnishes room for the development of its long wings. When the sun is low, morning or evening, the creature can be seen darting from branch to branch, and from tree to tree in the sunbeams. The limbs for locomotion furnished by Nature are very rudimentary and clumsy, and if the insect falls from the tree it is quite probable that it can never ascend the tree again. As soon as it locates, and begins to secrete its covering, it has no more use for legs, and they speedily disappear. They become involved in the secretion, and form a part of the scale. This description does not apply to the so called red scale of the San Gabriel Valley.

Reproduction begins when the female is two months old, and continues all the summer through, and into the winter. If an adult female be dissected and examined under a microscope of high power, only from three to four eggs, in various stages of development, will be found, only one of which will be sufficiently mature for exit, and the others graded to a minimum. The late Matthew Cooke thought that two to four per day are sent forth for a season, and that three or four broods follow each other during a summer, but it has become evident to me that but one per day is placed, and *that*, not in broods, but constantly until the storms of winter end the whole business.

The insect world is full of mystery. Great progress has been made during the last half century, but a multitude of problems remain unsolved. In 1852–53, Baron Von Siebold and Baron Von Bueleps, scientists in the employ of the Prussian Government, experimented in Silesia with the egg of the honey bee, using the most powerful microscopes, and unveiled the mysteries that had for ages involved *that* wonderful insect. The true parthenogenesis of that hymenoptera developed by these two gentlemen, has already made the world flow with honey. These experiments throw light on our pathway in our entomological studies

The question has been asked a thousand times at our pomological meetings and elsewhere: "How do the scale insects, being wingless and footless, succeed in spreading themselves from tree to tree and from grove to grove so rapidly?" The stereotyped answer has been: "Oh, the birds, the bees, and gossomer spiders." Is it possible that Nature has been so lame in her provision for the spread of her own offspring? No entomologist has, so far as my knowledge goes, attempted to tell us anything of the time or manner of the fecundation of the red scale. When this is told it will explain, or solve, the problem. It is a fact well observed, that the wingless scale and phylloxera spread in the direction of the prevailing wind. An orange grove, infested with red scale, will spread the insects broadcast for miles away in the direction of the prevailing wind, and lodge them on vines, trees, and weeds, and every description of vegetation. I know this from actual observation. The Santa

Ana Cañon, in the latter part of the summer, is filled with them through its entire length; they are found on the mistletoe boughs of the sycamore, the castor beans, and on the tops of the gum trees. How do they get there? I will give my theory for what it is worth. The male, in coition, mounts on the wind, bearing his load with his long wings wherever the wind wafts him, and it matters but little to him where he leaves his load. I have seen pumpkins in the field nicely specked with red scale.

The picture, to the horticulturist, is not a pleasant one to contemplate, but it may be remembered that these insects cannot survive the winter on deciduous trees and annual plants. Their home is the citrus tree, and if that is kept free from them they must disappear.

Two methods for its destruction are now in use—the resin wash and fumigation by hydrocyanic acid gas—each of which are available. Several orchards in Orange County have been greatly benefited by the use of the resin wash. Some that yielded their owners no profit last year have this season yielded a handsome return. The experience of the past can be greatly improved the year to come.

The best time to use this remedy is early in the season before the scale infects the fruit.

Fumigating has not been sufficiently tested to speak positively of the result.

A parasite for the red scale (*Aspidiotus aurantii*) would be hailed with delight by all orange growers, but no effectual parasite has yet been found. The success of the *Vedalia cardinalis* on the white scale has inspired the hope that an effective parasite for the red scale may yet be found. But it will not do to wait for parasites. The fight must go on. We must destroy the red scale, or it will destroy us.

It is unfortunate for us that so many orange groves in this county are in litigation, and so many are held by non-resident owners, who do not appreciate the gravity of the situation. One of these groves, if neglected through the coming season, will breed more scale for distribution over the county than all the scale fighters in the county can kill.

Something must be done to remedy this evil. The Commissioners will be powerless unless the Supervisors sustain them. Articles are passing around the State in the public press proclaiming the discovery of a parasite—a cross between the *Vedalia cardinalis* and the twice-stabbed ladybird—that is devouring the red scale. The bug intended to be described is the *Chilocorus bivulnerus*, which has been common in Southern California for a long time, and has no efficiency as a parasite of the red scale or any other. The Los Angeles County Board last August inclosed a tree in Mr. Kercheval's grove, and placed thereon a large number of the so called parasites, the *Chilocorus bivulnerus*, and found them unable to make any impression on the red scale. Such misrepresentations may deceive the newcomer among us, and enable us to unload our real estate, but they bring no good to horticulture. The entomologist can see at once the folly of the proposition. The methods of reproduction of the two bugs are so different that no cross is possible.

The State Board of Horticulture of this State and the Entomological Department at Washington are doing all that need to be done to bring to light a parasite for the red scale, if one exists anywhere on the face of the earth. The work has been in progress over two years without success, and until success comes we must continue the fight with such means as we find at hand.

DISCUSSION ON INSECT PESTS.

The President: You have heard the essays that have just been read on insects and remedies for their extermination. They are now before the Convention for discussion.

Mr. Abbot Kinney, of Lamanda Park: All of us orange growers owe a great debt to those persons who helped in the introduction of the enemy of the cottony cushion scale into this community—the *Vedalia cardinalis*. There are a number of gentlemen to whom our thanks are due; I would therefore like to introduce this resolution, Mr. Chairman, if it is appropriate at this time:

Whereas, The introduction of the *Vedalia cardinalis*—the enemy of the cottony cushion scale—saved to California many of our ornamental plants and trees, and saved the great orange industry from destruction; therefore, be it

Resolved, That the fruit growers of California offer their hearty thanks to all in any way engaged in this most important result, and especially to the Hon. Frank McCoppin, and to Mr. Albert Koebele.

Unanimously adopted.

Mr. Lelong: While the subject of the *Vedalia cardinalis* has been touched upon by my friend Mr. Kinney, I would like to make a few remarks before we branch off into a general discussion of the subject. At our last Convention, held at Fresno, the President, in his opening address, said: "Before leaving the subject of the introduction and the benefits derived from the *Vedalia cardinalis* in this State, I would suggest that some substantial token of our regard be presented to Mr. Albert Koebele. Such action would be a proper stimulant to future searches. It would be just, for the reason that he was exposed in a locality of intense heat while searching for parasites, and was reduced to a malarial condition that cost him much time and money." (Continuing reading from page 385, annual report). Now, Mr. President, when we arrived in Los Angeles the fruit growers of this section—I speak of Southern California—were circulating a petition asking for contributions among themselves, for the purpose of presenting Mr. Koebele with a token of appreciation. I was requested by them to bring this matter before the Convention. The petition has already been drawn, as follows: "Considering the great importance to the fruit industry of the discovery and successful introduction into California of the Australian ladybird (*Vedalia cardinalis*), and being desirous of showing our appreciation and regard for the discoverer, Albert Koebele, we, the undersigned fruit growers of California, subscribe the sums set opposite our names, for the purpose of purchasing a suitable token to be presented to said Mr. Albert Koebele as a souvenir of a duty well performed."

It is signed by several already, who have subscribed the amounts set opposite their names. And if I may be allowed, Mr. President, I would move that a committee of one be appointed from each county here represented, to secure subscriptions towards purchasing a token as indicated, and to report before the close of this Convention.

Motion carried.

The President: A few names have been handed in to me to announce as the committee to solicit subscriptions for a token of our regard to Mr. Albert Koebele. The committee that I name for that purpose is Alexander Craw, Los Angeles County; W. E. Collins, San Bernardino County; Prof. T. N. Snow, Santa Barbara County; Frank A. Kimball, San Diego County; Sol. Runyon, Sacramento County.

DISCUSSION ON INSECT PESTS, RESUMED.

Mr. Carroll having criticized the action of the Inspectors of San Bernardino County in quarantining his nursery stock, in a discussion upon the essay of Mr. W. E. Collins, of Ontario, the President said: I will state that we are not here to discuss the laws and provisions that the different County Commissioners may deem fit to exercise. Also, that where a nursery is surrounded by insect pests it ought to be a sufficient reason, that is, very nearly a sufficient reason, to prevent those trees from being distributed around over the State without very, very careful inspection.

The essays that you have heard read, on insects and their extermination, are now before the Convention for discussion.

Mr. Collins: Mr. President, I would like to supplement my own paper on insect pests, or rather quarantine regulations, by moving a resolution:

That a committee of five be appointed by the President, to consider and report to this Convention, at the earliest possible moment, what changes in the law are necessary to aid in the suppression of dissemination of scale and other insect pests.

My object in moving this resolution at this time is that the committee may have time to fully consider the subject and report to this Convention before some of the members may be forced to leave. And this being the first day of the session, if the committee be appointed now, probably after a meeting or two it may report to the full Convention, while if the subject be deferred to a later moment many would leave and there would be only a partial representation in the Convention.

The motion was seconded by H. P. Stabler, and carried.

Mr. H. C. Dillon, of Long Beach: In view of the appointment of a committee of that kind I would like to offer a suggestion. I believe that every person who has had any experience in quarantining against districts, either as against cattle or against any kind of disease or pest, has found that they have been failures in operation. We ought, therefore, to go for the individual every time, and not for districts. And that is the suggestion that I would offer to any committee that may be appointed by the Chair. For instance, if a nurseryman has clean trees, which he has grown upon clean ground by the exercise of extraordinary diligence and by the use of everything that he can learn of in order to destroy these pests, he ought to be rewarded by the community by allowing him to sell his trees to any person who desires to receive them. That is justice to him and it is justice to the purchaser. Therefore, I would say that in framing any law of this kind it ought to be a law which shall say that the Commissioners shall inspect all trees that may be received at any point of destination, and if they be found to be free from disease they shall be delivered; otherwise, they shall be sent back.

Prof. T. N. Snow, of Santa Barbara: Forty years ago I joined a society to suppress the worst pest that ever infested the earth, probably. I have investigated it since I have been on the Horticultural Commission for Santa Barbara County, to ascertain its origin and its history somewhat. I have traced it back to a very early date, and I have found no book that would give me the scientific name, and so I venture to name it to-day the *Vicanum arboris scientia*, or the black scale of the interior of New York, and I believe it exists up to the present time. We are in

utter ignorance of the great pests. We don't know so much as we pretend to. I have found that out during the last forty years. For a few months I have been working with you, although not among you, to cause the destruction of the cottony cushion scale and other insect pests. I erected a large tent on the third day of August, and became the laughing stock of Santa Barbara for three or four weeks. Afterwards the laugh was on the other side, for my method was very effective. I learned to-day that "the white scale is virtually a thing of the past." If I am right in my investigations within a few weeks, the white scale is still hatching. But the Vedalia has been with us, and is after these young white scale.

The President: I should like to inquire whether Professor Coquillett is present, and if so, whether he could give us some description of the insect that has been reported destroying the San Gabriel red scale—whether he knows anything about it.

Mr. D. W. Coquillett: Mr. President, in regard to a parasite that has been preying on the San Gabriel red scale, I am hardly able to report anything definite. There is such a thing in existence, but it does not seem to multiply rapidly enough to keep the red scale in check; and this is true of the ladybirds that feed on the scale.

Mr. J. H. Kellom, of Tustin: We have a plan of getting rid of the red scale at Orange; it is by the use of hydrocyanic acid gas. It has been experimented with by gentlemen who are on this floor for two or three years; but new improvements have been made lately, and the questions about those improvements are in dispute between Mr. Coquillett and certain parties in Orange County. I have no particular interest in who discovered it, or anything about it, only I know it is a grand discovery. The plan is to dispense with all the blowers, and all the extra paraphernalia that they have heretofore used, and put the gas directly on the tree under a tent in the dark. My theory, which I have taken from Zell's Encyclopædia, is that it will not prove effective in the daytime, simply because the actinic rays of the sun decompose the gas and make it ineffectual in the destruction of bugs. But three or four parties down there are working now every night by moonlight with this gas fumigating, and I believe that they are making a grand success of it, and it is absolutely a little cheaper than the wash. The plan of operation is to use four tents—two tents on one wagon, and have two wagons—and three men will man the two wagons. They are made in such a way that they do not need any horses or animals of any kind. The three men will shove the wagon from one row of trees to another. At the top of a mast there is a cross-bar, and at each end of the cross-bar is swung a tent. As the wagon is moved on the tent is drawn up, and when it comes right over other trees they drop it down, and five minutes is all that is necessary for the work of moving. Then they put the gas in an earthen vessel under the tent, and give it just fifteen minutes and no more. While these fifteen minutes are passing, the same men pass the other wagon with the other tents along, and in that way in every twenty minutes four trees are fumigated, or twelve trees per hour; and allowing all necessary delays and uncertainties about the work, it is a simple and easy matter to fumigate one hundred trees in a day when they can do it in the daytime, but it can be done just as well in the moonlight. It is found also, in the use of this gas, that the thermometer must not go above 80 degrees; also, that there must be no fog, and that the trees are dry,

because if the tree is wet the undue proportion of water in the gas weakens it. In these two remedies, without any parasite whatever, is found a simple and expeditious way of ridding the county of red scale. As I said in my paper (Report of State Board of Horticulture, 1889), the red scale is broadcast. It cannot live on the weeds; it can live only on the citrus trees in the winter. As soon as the rains commence it diminishes down to the present time, and now there are very few red scale to be found on any tree; but there are enough for seed, and they will loom up again as soon as the summer comes. The fact of the matter is, if the tree is not fumigated or washed within the next ninety days, next summer it will be just as bad as it was last. But with this work in the hands of good, honest Horticultural Commissioners in each county, the State can be rid of red scale. I would like to see a parasite, because that would make still less work; but until the parasite comes, why, the Commissioners that are at work at this business must be sustained by the Boards of Supervisors and by the horticulturists themselves.

Mr. T. E. Smith, of Santa Ana: I simply wish, in a few words, to second what Mr. Hamilton has said about this new gas treatment for red scale. There is no question in the mind of any one who has carefully examined the working of this gas treatment, but that it is entirely effectual and at a minimum cost. There is one drawback to it against the resin wash for people who have small orchards or limited means at the present time, and that is the cost of the plant. Mr. H. K. Snow, of Tustin, told me last week that he had just completed two plants—four tents, with the rigging on two wagons, exclusive of the running gear. It costs about $300 for the four tents and rigging. And I presume that Mr. Hamilton mis-spoke, in speaking of the gas when applied in daylight, not doing the work. It does the work when used in the daylight under a dark tent, but if the tent is removed immediately after the work is completed, or within a short time, there is some action, unknown, I suppose, to every one yet, but some chemical action takes place through the actinic rays, or through the rays of light, which causes injury to the tree. The tree is frequently very badly injured if treated in the daylight. But in both instances, where they are treated in the daytime, or at night, other conditions being right, the scale will all be killed. But as I said, it is too costly for some of us to use at present. Of course the time will come when people make it a business of going around from orchard to orchard and treating our trees. But in the meantime we must spray with the resin wash and keep the scale down until we can use this gas or some better remedy than the resin wash, and thus make orange and lemon growing pay.

Mr. A. Block, of Santa Clara: You can make the resin wash without any caustic soda whatsoever. I am using it for the San José scale, but not using any soda with it at all. I am using sal soda instead. The only difference in the work is simply this: that while I could make my soap, as I call it, resin soap, in ten minutes with caustic soda, it will take me three hours to make it with sal soda. I use a larger proportion of sal soda, in weight, than I would caustic soda. It takes a great deal longer to make it, but the work is effective; the destruction of the scale is positive. I don't use it in the winter, but in the summer, and my fruit is clean. I am sorry that I have not the exact proportions with me or I would give them to you. But you can make it

by using sal soda instead of caustic soda, and you can use less caustic soda by boiling it longer.

Mr. Muscott, of San Bernardino: I would like to inquire of Mr. Compere whether he has used this wash for the San José scale, and if so, what time it is tried?

Mr. Compere, of Los Angeles: I have used it for San José scale in some instances, and found it very effective. The only difference is, in place of using six pounds of caustic soda, use nine pounds of caustic soda and thirty pounds of resin, and you will have a very effective wash.

Mr. I. H. Thomas, of Visalia: In answer to a question about the lime, sulphur, and salt wash, I don't see the advantage of using fifty pounds of lime, because it is not the lime that kills the scale, it is the sulphur; and instead of using twenty pounds extra of lime in this recipe of mine, I would take that caustic and put it into sulphur. I used, this season, twenty-five pounds of sulphur, thirty pounds of lime, and fifteen pounds of salt. Now, a great deal of the success of this recipe depends upon the cooking of it, and also a good deal upon the lime. You want to get good, fresh lime, so it will slack readily. Take twenty pounds of lime instead of the amount given in the recipe there, fifteen pounds of salt, twenty gallons of water, and twenty pounds of sulphur; cook that all together. Slack your extra ten pounds of lime in the extra water to make fifty or fifty-five gallons. It will take an hour's good, thorough boiling to make that preparation correctly; and then spray it on, and I don't believe you will have any trouble in killing all the scale. I use the common California sulphur, and we made an estimate of the cost this season. The cost on a six-year old orchard was about 6 cents per tree, according to the recipe I give. Counting labor at $1 75 a day, sulphur at 2¾ cents a pound, lime at $3 a barrel, the salt at 1 cent a pound, makes the cost, on an average, about 6 cents a tree. My estimate is on an orchard of six or seven hundred trees. I would not like to spray later than when the bloom is half out. After the tree is in full bloom, I think spraying will injure some of the fruit. It is the cooking of the salt in with the sulphur which makes it dissolve. Heretofore I slacked the salt in with the lime in the barrel, and it didn't dissolve, and didn't adhere to the trees. This year, using the same proportions, and cooking it more, the orchard looks white all over. I attributed it to the boiling of the salt in with the sulphur, so it is thoroughly dissolved. (See annual report for 1889, page 172, Winter Remedy, A.)

Mr. A. Block: The best time to spray trees is in November and December; as soon as it can be done after the leaves are off.

A Member: Is there any parasite for the San José scale? If so, what is the insect? I know of an instance in which several San José scale on an apple tree limb were perforated, and it was thought it must have been done by some parasite.

Mr. B. M. Lelong: Yes, sir; the *Aphelinus fuscipennis*. The first account of this parasite was in 1880. It was discovered in Santa Clara County, but it has worked very slowly. The second account was in 1888, found in Los Angeles, on Washington Street. And since that time there have been colonies taken into Sonoma and Mendocino Counties, and they are being propagated now for distribution in the San Gabriel Valley. But they work very slowly. That is the only trouble.

The President: It is now approaching the hour when we must close the discussion for to-day. The gentleman from Humboldt County, Mr.

A. P. Campton, wants to get some information about the woolly aphis on the apple. If some gentleman would give a brief statement with regard to how to arrest the woolly aphis on the apple it will be in order to do so.

Mr. Compere: About the only method I have found to exterminate them is by the roots, tree and all, and burn them up. That is the only remedy I have found to be successful.

Mr. Lelong: The best way to treat them is laid down in the annual report of the Board, page 215. The remedy there recommended has done the best of anything.

Mr. Campton: We have tried all those remedies, with a certain degree of success, but are not entirely satisfied. We are living in the coast climate where the atmosphere is damp, and the woolly aphis appears to work more there than in any other place. I have seen them so thick that by giving trees a slight shake the ground will be covered and look perfectly white like snow. It is not so all over our county, but it is so along the coast. I had a young orchard and got entirely rid of the aphis, but the trees were only about three years old when I started in, and I did it by washing the trees thoroughly with lye and pouring it down around the roots. I think that we might get a remedy that would work better than that. It took me three years to rid my orchard in this way. If any gentleman here could give us any new idea we would be glad to receive it.

The President: I will state for the benefit of the gentleman, that I have experimented for seven years on the woolly aphis with caustic soda. It is a certain remedy to keep the woolly aphis in check. Bare the roots every spring, and swab them as far as you can three feet from the trunk in a circle with a solution of caustic soda, one pound of caustic soda, 60 per cent, and one gallon of water. Repeat two or three times, if you see a return of the trouble. And also swab all places on the trunk or tree where there have been cuts or open places, by a swab. Simply touching the place infected will kill every insect touched.

COMMITTEE ON LEGISLATION.

For the committee on resolution offered by Mr. Collins, to suggest changes in the law, I will name W. E. Collins, H. P. Stabler, Alex. Craw, W. H. Aiken, and Colonel J. E. Jones.

The Convention then took a recess, to meet on the morning of the twelfth.

SECOND DAY'S PROCEEDINGS.

Wednesday, March 12, 1890.

The President called the Convention to order promptly at 9:30 A. M., and the regular programme was taken up.

PLANTING, CULTIVATION, AND PRUNING.

TRANSPLANTING AND PRUNING.

Essay by G. W. VARNUM, Elsinore.

Horticulture is indeed a science and a noble calling. There is no more innocent enjoyment. What a terrible blow it must have been to our first parents when they were driven from their beautiful Eden, to wander homeless and houseless through earth's wilderness. But they certainly must have returned to their first calling, and with brows dripping with perspiration, worked the stubborn earth until they brought it into subjection, and again had a garden to remind them of their lost Paradise, and to furnish them the fruits necessary for their sustenance. Paradise! Where was it? I often think that it might have been in California, for surely there can be no more delightful country on earth, and no place where a poor mortal can be so happy and contented, as he can in California, particularly on Coronado, or in the citrus belt of Southern California. Northern California may be equally delightful, but as I have never been north of Los Angeles, I am unable to say anything about it.

When I purchased the trees for my first orchard I asked the nurseryman to show me how to prune a tree. He dug up a "Rawle's Janet," and cut off every limb within two or three inches of the trunk, and said, "That is the way to prune a tree." I did not like it. When I got home I planted fifty apple trees, but did not prune the tops; the roots I pruned smoothly where they were bruised in lifting. I also planted the *broomstick* as carefully as I did the trees. The result was this: the *pruned tree died*, and the unpruned lived, and grew rapidly, and in due time bore fruit. This satisfied me that it was not best to shorten in a tree when it is transplanted.

In 1860 I planted my second orchard, one hundred apple, besides pear and other trees. I did not dig holes, except for pears, but planted nearly on top of the ground, on land which had its first crop (wheat) on it the year before. I staked the ground, and scraped away about six inches of soil at each stake, set the trees at the stakes, pulled the rich soil on the roots with a hoe, mulches six inches deep with wheat chaff, and let them grow, and they did grow. They made three and one half feet of new wood that season. These trees, you may be sure, were planted whole, nothing but the ends of the roots pruned. They were taken up in the fall, buried root and branch in a trench two feet deep, and taken up and planted in the spring as soon as the ground was in proper condition.

I will state why I did not dig holes. After planting my first orchard I cultivated, by turning the furrow to the trees, for three years; they then stopped growing. I concluded that the roots were too deep, and turned the soil away until I got the ground level again. The trees then began to grow again as thrifty as they did the first season. I made up my mind that apple tree roots did not want to go deep, so I planted my second orchard as stated above, nearly on top of the ground. Pear trees, I noticed, sent their roots down, and I dug holes for them. Peaches do the same.

Downing, in his "Fruit Trees in America," says: "Trees should not

be pruned much when transplanted." I will now give reasons why they should not be cut back or pruned. The tree has been mutilated enough by digging it up. Frequently half or three quarters of the roots are gone. What does the tree need? Roots. How is it to make new roots? It has a store of sap in it when taken up. It can, although deprived of a large part of its roots, still take up a little water from the earth. The sap which is in the trunk and branches at the proper time forces the terminal buds to swell, open, and develop leaves. These leaves digest, or elaborate, the sap, or rather it is converted into cellulose, after being taken up by the roots as water and carbonic acid. By the action of the sun on the leaves oxygen gas is given off and the sap is converted into cellulose, or plant food, or fabric. Ten parts of water and twelve of carbon represent one part of cellulose; and to make it out of water and carbonic acid the latter gives up all its oxygen. Sunshine decomposes carbonic acid and turns the carbon and water into cellulose. This function is performed by the leaves. If the tree is pruned, these terminal buds are cut off, and as they are the first to start, your broomstick has to depend on dormant buds (which are slow in starting, some remaining dormant for years) to furnish the plant fabric, which is needed to make new roots. Again, the cut extremities of the branches are open and the little sap left in the tree pops out at the cut ends and is lost. When the tree is not pruned the new leaves on the ends of the uncut branches start early and grow rapidly, and the elaborated sap finds its way through the combined layer, or inner bark, to the roots, and new rootlets are developed and start rapidly into growth, and soon make up for those lost in taking up the tree. A tree cannot make much, if any, root without leaves. The leaves are the *stomach* and *lungs* of the tree; without leaves the tree can do nothing. When deciduous trees shed their leaves in the fall they are done growing and making roots for that season. It is absolutely necessary that the tree should have leaves to be able to make new roots, unless a large quantity of cellulose has been stored up.

Now, plant your *broomstick;* what does it do? It loses what little sap it had by evaporation from the cut ends of the branches, and by being forced out by the power which causes the sap to rise in the tree, and that power you know is very great, capable of lifting many pounds by the sheer force which pushes up the sap. The broomstick has not enough roots of the right kind (for old roots lose the power of absorbing nourishment) to take in the fluids held in the earth in sufficient quantity for its needs. If it happen to be a good season it will struggle on and live, but will make but little growth. But if it is a dry season, unless it is frequently watered, it will put out a few sickly leaves from the dormant buds and will probably die.

I planted four peach trees at Elsinore; they had been *faithfully* pruned by the nurseryman who sent them out. One had *three* buds, one had *two*, another *one*, and the fourth had no buds at all. The three which had buds lived, and made a branch from each bud kindly left. The one which had *all* the buds rubbed off kept green all summer, but having nothing to start from at last gave up and died.

These are facts, gentlemen, and I want you all to try this experiment: Get ten trees as nearly alike in roots and branches as possible; prune the roots of the ten trees carefully. A bruised-off root may kill a tree almost as certainly as a man would die if he had a leg or an arm taken

off by a round shot or a shell, and left the wound in that condition without calling the surgeon to make a clean cut surface, which would be the only way to save his life. Therefore, prune the roots smoothly with a sloping or diagonal cut, with a very sharp knife. Now, make broomsticks of five of the trees and leave the other five whole; don't cut a twig off. Plant the ten trees carefully, water and cultivate alike, and see which do the better. I will guarantee that after trying it once you will never prune a tree again when you transplant it, if you were to plant a million.

The next year after planting a tree, if there is any pruning to be done, I prune; or, if the season has been so favorable that the tree has made a luxuriant growth, showing that it has also refurnished itself with roots, I would cut out all superfluous limbs, all that crop each other, and, perhaps, take off those very near the ground. I would have the head low for many reasons; not over three feet to the first limb, then leave a limb every one or two feet, spirally around the tree, if possible, or so as to have a symmetrical head. It will take several years to perfect the head. Remember that the tree will grow many feet high, and for this reason it would not do to leave a great many branches, or they would be too crowded. This is for the young tree while forming the head. Apricot or peach trees, if on wet land, or often irrigated, will require severe shortening, or they will make fishing poles. As these trees are apt to overbear, it is well to cut back the last season's growth about one half, and you will have larger and finer fruit. This cutting back is done in winter. If your orchard is on high, dry land, and you do not irrigate, little or no pruning should be done. My apricot orchard is on high, very dry land, and it has not been watered for two years. It has been planted five years. I have never pruned them, and I have never seen better shaped trees, nor have I ever seen larger or more delicious apricots than they produced; and I am not the only one who says so. I have two or three trees which get the water which overflows from my tank. These trees have grown rather straggling, but the fruit is not as good as it is on the unwatered trees. There are apricot orchards on wet land near my place which grow rampantly, but the fruit is not as large, nor is it of as fine flavor as mine.

The trunks of young trees must be protected from the sun, or the sap in the combined layer will be scalded and it will turn sour and the bark will die on the southwest side; the tree will then bend towards the northeast and expose more of its trunk to the sun's rays, thus making matters worse. The sour sap attracts the borer, which deposits its eggs in the diseased bark, and the tree is soon destroyed. Therefore, if you give your trees high heads so as to get up to them with your horse and cultivator, it will be well to wrap the trunks with white cotton cloth or some other material. I have found the leaves of the yucca very good for that purpose; two will envelop a small tree, and three or four will cover trees one or two inches in diameter. Stand them up around the tree, hollow side in; cut off an inch or two of the pointed end; then tie at top, middle, and bottom, and your tree is protected from the sun, rabbits, and borers. Soft soap put on with a brush about twice a year is one of the best applications I have ever tried to keep rabbits and borers away. It also leaves the bark in a healthy and vigorous condition. By making your heads low you have the trunk shaded. The fruit is convenient for picking, and the ground is shaded under the trees, which prevents evaporation

and serves almost as well as a good mulching. The weeds will not grow as rank in the shade, and a few strokes of the hoe or rake will sufficiently loosen the soil about the tree where the cultivator does not reach.

Ornamental evergreen trees ought never to be pruned. You cannot improve them; their natural growth is as beautiful as possible, and pruning spoils them to an esthetic eye.

Orange and lemon trees should be let alone until they are three or four years old; then the dense spray in the center of the tree may be cut away, leaving all main branches which do not crop or chafe each other. I saw last summer what was left of a once fine orange orchard, which was nearly all killed by trimming the trees up five or six feet high, so as to be able to get up to them with the cultivator. The trunks were exposed to the sun and it killed them. Orange and lemon trees should be left with all their branches on until the head is large enough to shade the trunk. Then you may take off the lower limbs if you are crazy to prune. Olive trees require very little pruning until they are five or six years old. Take off the suckers, or better, heap up the earth around them and let them root; then take them off with a fine saw and plant them. This is the easiest way to raise them, unless you have a hothouse to give cuttings bottom heat. Keep the trunk shaded until the outside bark is hardened and impervious to the sun's rays.

The pear is another tree which needs but little pruning; so is the fig. If you want to ruin your fig trees, for several years shorten in the limbs and you will succeed admirably. Cropping or straggling limbs are always an exception; also any limbs which grow at a very acute angle with the trunk, particularly on apricot trees. Such limbs should be cut away before they get much growth, as they are sure to split off when the tree gets a good size. Where limbs of large size are taken off, the stump should be shaved smooth with a sharp knife, and then coated with grafting wax or shellac varnish, to prevent rotting.

OBJECTS OF PRUNING.

The first is to form the head; the second is to prevent the tree from overbearing, as peaches, plums, and apricots are apt to do, thereby making smaller fruit and breaking down the trees. The remedy already stated is to shorten in the last season's growth.

Some have a third object, that is to make what is called an open head, so as to let the sun shine on the fruit. I think this is fallacious. I find the choicest oranges, figs, apricots, and other fruits in the most shaded parts of the trees. If it was intended to expose the fruit to the sun, Nature would not make a dense growth of wood and leaves beyond the last year's wood, on which you find the fruit. A friend of mine in Missouri had a long trellis eight feet high, covered with Concord vines, which were loaded with grapes. He thought he would give them the much extolled advantage of sun and air, so as to ripen them quickly; so he cut off every leaf which shaded a grape. Did they ripen? No. The grapes remained green and soured on the vines and were utterly worthless. Leaves have several functions. One is to shade the trunk, tender branches, and fruit; another is to suck up sap, or rather to receive that which is forced up by some power not understood, partly by capillary attraction, but perhaps more by endosmosis. Another function is, as before stated, to give off in sunshine all the oxygen contained in the

carbonic acid which comes up from the ground with the sap, thus converted into cellulose, or plant fabric. Starch and sugar are chemically the same, and plants easily convert one into the other. The oils, acids, jelly, pulp, fruits, etc., are all formed out of the carbonic acid and water, or sap. Thus, after the leaves have assimilated or digested the sap, it is returned to all parts of the tree or plant to build up and ripen the fruit, as well as the tissues of all parts of the tree and roots.

I am in favor of judicious pruning, but I am opposed to barbarity. I don't believe in "Jack always keeping his knife sharp for the purpose of hacking off a limb every time he comes near a tree."

I think we prune to excess. There is no use in cutting grapevines here as they do in Europe. There the vines are trimmed so as to sustain themselves, because stakes are out of the question. Where poplar trees are shorn like a mule's tail for the wood for making charcoal for cooking purposes, wood is scarce. I have seen in Europe miles of poplar trees, on each side of the roads, trimmed up as high as a man dare climb; so the vines are trimmed to make them stand alone. I am sure our vines would bear five times as much as they do if five times as many eyes were left on each cane, instead of cutting all canes back to two eyes. If the ground is not rich enough to bring the fruit to its highest perfection, *fertilize* it. More fertilizing and less pruning would be, in my judgment, the wisest course to pursue. Why not prune walnut, pear, persimmon, and other trees, as we prune our fruit trees? There is as much reason for pruning them as there is for pruning other trees.

Gentlemen, we are near the twentieth century, and I hope the world is more enlightened than it was sixty years ago, and that the inhabitants will discover many new things and facts, among them the fact that an unpruned tree when transplanted is more certain to live and does far better than a pruned tree, and that when they feel determined to do some pruning they will curb their fury until the next year, when they can go at it without danger of killing the tree. If I have opened an avenue of thought which will lead to knowledge or good results, I will be thankful, and will feel well repaid for the trouble of engrossing so much verbiage.

CHERRY CULTURE.

Essay by GILBERT TOMPKINS, San Leandro.

Taking one year with another, there is no fruit that gives more satisfactory returns throughout this section of the country than the cherry. The rich valley land that lies around San Leandro, San Lorenzo, and Haywards, is unusually well fitted for cherry culture in both soil and climate. In former days San Francisco received a very large proportion of the entire amount of cherries consumed from the pioneer cherry orchards of San Lorenzo and vicinity. Many other sections of the State produce at the present day fine fruit in large quantities, and the virtual monopoly formerly held by this district has disappeared, although the business is still very profitable at prices about one tenth the size of those received fifteen and twenty years ago.

In my experience the best results have been gained on rich, not too light, valley land; adobe is not so well suited for the cherry as a lighter

and more friable soil. On the other hand, I would not choose a soil containing much sand or gravel for the site of a profitable cherry orchard, although this may not be the experience of cherry growers in other parts of the State.

The trees are slow in coming into bearing. A sample of the fruit may be expected in a few years after planting, but there is a great difference between an occasional handful of fruit and a crop large enough to pay for the expense of cultivating the orchard and handling the fruit. I doubt if a cherry orchard will really pay in this section before it is eight years of age, although some varieties produce profitable crops earlier than others. The Rockport Bigarreau is one of the best standard varieties as an early producer. The Napoleon Bigarreau (Royal Ann) seldom gets down to actual bearing before the trees are nine or ten years of age. There are exceptional cases that differ from what I have just stated.

The cultivation required depends very much on the soil and circumstances. The Souther Farm orchard is plowed from two to three times a year, and weed knives and cultivators are kept going as they are needed. I have adopted the plan of pruning every other year; I think that is the best plan for any tree that is so apt to run to wood growth, as is the cherry, on our rich land. By leaving the trees unpruned there is not that stimulus given to the production of wood, and the energy of the tree is more generally used in forming fruit wood. Downing states that the generally accepted theory of the formation of fruit wood is the ripening of the sap in the limbs of the tree. If the branches are left uncut the ripening process goes on much faster than when the growth of the tree is perpetually stimulated by the cutting of the branches.

With proper handling cherries are one of the best of the shipping fruits. While many parts of the State produce good cherries, the area of land suitable is much less than for many other fruits; so with improved shipping facilities, we look for a steady and profitable market for all first class cherries.

ALMOND CULTURE.

Essay by Webster Treat, Davisville.

In California there are many districts that are adapted to the successful growing of the almond.

Almond culture on this coast has not been very profitable, for the reason that the Languedoc, an old French variety, has been propagated, and that nut is a very irregular bearer. The Tarragona is another variety. It is a somewhat longer nut than the Languedoc, and still rougher looking. None of these can be at all compared with the beautiful shapes and the fine, smooth appearance of the almonds of a number of seedlings raised lately in California. But now that new varieties have been propagated here, which have proven themselves to be steady, prolific bearers, and superior nuts in every respect, it is only a question of time, and I think a very short time, when California almonds will drive the imported article entirely out of the American market; and I can even see our growers shipping almonds into the European markets,

and our superior product selling at a higher price as against their home article.

It is not my intention in this essay to give an exhaustive history of the almond, for its biography is a long one, and, though it might be interesting to some, would not be information out of which much profit could be had.

Almonds may be divided into three general classes: the paper-shell, the soft-shell, and the hard-shell. There are, between these three classes, kinds of almonds that cannot be placed in any of them. Take, for instance, the Drake's Seedling; it is somewhat beyond the degree of hardness for a soft-shell, yet neither can it be called a hard-shell. I have examined different varieties of paper-shells, and find that there are two kinds—the proper or true paper-shell, and what may be called a false paper-shell. The false paper-shell has two quite distinct shells, and in removing the hull, the outer shell detaches from the inner shell and remains in the hull, while the nut comes out with only a very imperfect inner shell. The *true* paper-shell detaches directly from the hull, and has but one distinct and *paper* shell. The "California" is one of the latter varieties of paper-shells, and is also an extremely heavy and regular bearer.

The paper-shell almonds bring nearly double the price of soft-shells, while the hard-shells are sold only in limited quantities for the drug trade.

A portion of the trade in almonds is taken by the confectioners. They pay the most for nuts with perfectly smooth and plump kernels, always looking for smoothness before size. The confectioners want the smooth kernels for their fine candies, and this is the reason that the Languedoc does not sell to them, because its meat is rough and wrinkled.

The almond will do better on a thin, dry soil than any fruit tree; but when given the richest black loam, and the right amount of water, it will produce double what it will on a dry soil. It is a sure thing to say that the almond will thrive and bear excellent crops on any soil that will grow good peaches. The tree cannot withstand a large amount of water, but, on the other hand, it will thrive and bear good crops on a dry soil which would not support a fruit tree.

There is somewhat of a diversity of opinion as to the best root upon which to establish the almond tree. The late G. G. Briggs would have an almond on no other but a peach root, saying that it will make a heavier and quicker growth, and consequently large crops will come sooner. Others contend that as the peach does not live as long as the almond, the peach is not the proper root, as it would become useless long before the life of the almond tree above it should end. One fact is certainly established, and that is: the almond sends its roots down very much deeper into the ground than the peach, and is consequently much better adapted to a dry soil. In my own experience, it remains to be seen whether a peach root will or will not furnish sustenance for the almond tree above it as long as the latter lives. The peach root, in transplanting, will be surer to start, but the almond root once started will thrive on a poorer soil than the peach, for the reason that its roots are not all in a bunch like the peach, but are composed of a few very long lateral roots, and an extremely deep tap root.

After being planted, the tree requires so little care or attention that there is but little to be said on this part of the culture, and it requires

only pruning enough to give a good shape. After that point is made, no pruning at all is necessary, except to keep the tree from getting too thick at the top, and to keep any suckers out. After transplanting I cut the tree to one foot above the ground, and grow three limbs from that point. Never shorten in, as with the peach and apricot, for the almond is like the prune, bearing its largest crops on the long, slender branches. But it also bears nuts on the little short twigs on the inside of the tree. These inside twigs do not die out as in the peach and apricot, but live and get more stubby and strong, bearing almonds every year; and because of the tree bearing a part of its crop close against and around the larger limbs, it is desirable to cut the tree off the first year to one foot high, and grow the main limbs from that point; this gives more limb surface for the small bearing twigs, and also tends to keep the tree nearer the ground. The almond is not troubled by any insect except the red spider, and this can be easily killed by spraying with the lime, sulphur, and salt wash in late winter, when the tree is dormant.

The process of gathering almonds and preparing them for market is very simple. When the hulls are opened pretty well, disclosing the nut, which is about the first of October, a large canvas sheet is spread under the tree, and the limbs are struck sharp blows with poles until all the nuts are shaken off. These poles are of the straightest grained Oregon pine, about fifteen feet long and one and a quarter inches square, with the edges rounded off a little. This striking of the limbs with the poles does not injure the tree at all, and it hulls a portion of the nuts. After gathering, the almonds are put through the hulling machine. The almond huller of the present day is rather an incomplete affair. It consists simply of an iron or wooden draper run by steam or horse power, carrying and rubbing the unhulled nuts against a stationary top-piece, which fits down just close enough to the draper to allow of the nuts passing through without breaking them. This rubbing and chafing takes the hull off, and then the nuts are separated from the hulls by hand. When the necessity comes for the invention of an almond-hulling and separating machine—and that will be soon, for California can grow almonds to greater profit than anything else—there will no doubt be invented a machine that will hull and separate the almonds from the mass of hulls, which will greatly cheapen the preparing of the crop.

After the almonds are separated from the hulls the nuts are bleached by sulphur fumes. My bleaching house is about twenty-five feet by eight feet, and I generally put in about four thousand pounds at one time, and expose them to the fumes of the sulphur for three or four hours; though the longer the nuts are bleached the whiter they become. Usually in bleaching soft-shells a little water is sprinkled over them before being put in the sulphur house, for the purpose of making them whiter. Care should be taken that no more sulphur is put in than will completely burn, for if too much sulphur is put in at one time, there will not be a complete combustion, and the soft-shells will smell of the sulphur, and the paper-shell kernels will taste of it.

My bleaching house is boarded with tongue and groove inside and out, and roofed with well laid shingles, and a flue about two feet high on the apex to help draft the sulphur smoke up. The floor is of one by three, set up edgeways, three eighths of an inch apart, or just wide enough to admit the sulphur fumes, and yet near enough to prevent the

nuts from falling through. The floor is about two and a half feet above the ground, and the lower space is boarded up with tongue and groove also, and fitted with small doors every five feet to admit of placing the pans of burning sulphur underneath the floor. It costs nearly two cents per pound to gather, hull, and bleach the almonds with our crude appliances for hulling and separating, wherein the greatest expense comes; but with a good huller and separator this could be reduced to half a cent per pound.

One of the many inducements to grow almonds is that the tree commences to bear at the age of three years, and some varieties bear an average of three pounds to the tree at that age. I saw blossoms on the "California" paper-shell tree this year, which tree was but one year old. It is probable that the blossoms will fall off, but it shows the very early age at which an almond tree may bear. When the tree is four years old, it will bear an average of thirteen pounds to the tree, and last year there were taken from one hundred and ninety five-year old trees three thousand five hundred and two pounds, which sold in Chicago at wholesale rates for 22 cents per pound. This is at the rate of $283 50 per acre on five-year old trees, planted twenty-five feet apart. Even from Languedoc trees I gathered one year, when they happened to bear a good crop, fully one hundred pounds from one tree, which was twelve years old. And with these fine new varieties that have been propagated in California, which bear much heavier than the Languedoc, and finer nuts, the prospect is for a very large yield when they are eight years old.

A person of no experience in tree growing can handle a crop of almonds as well as any one in the business, for the few points are so easy to learn that with a few written or verbal directions he can manage for himself. Another advantage of almond growing is that the crop ripens after grain has been harvested, and good help can then be obtained at a moderate price, and without trouble. Still another point is, that the almonds can be left on the tree, if for any reason they cannot be gathered at a certain time, and the grower can use his own time in gathering. Also, he can store the nuts, after preparing them for market, if he is not ready to sell them. All these are advantages not obtained in handling other fruits.

DISCUSSION.

THE PRESIDENT: The essays you have just heard read are now before the Convention for discussion, and if it is proper for the Chairman to have an opinion, I should like to say a few words on the first essay, on transplanting and pruning trees. I have written two essays that are in the reports of the State Board of Horticulture for 1886 and 1887. I have been in opposition to this theory of scalping trees, and am very glad that another gentleman has taken it up, because I got into a hornet's nest with my theory. Regarding the essay that has just been read on the almond culture, although I know the gentleman very well—he is a very smart, active, reliable young gentleman—I think he will lead you seriously astray on the cost of gathering almonds. He puts it there, that with improved machinery you can positively gather the nuts

at one half a cent a pound; I doubt if they can be brought from the field to the place of manipulating for any such sum.

Mr. Mark L. McDonald, of Santa Rosa: I just want to say a word. I listened very attentively to that first essay, and while I agree with him on some points that he made, yet I must disagree with him on others. I was convinced that the experience of the gentleman who wrote that essay is confined to one portion of the State, and had he been familiar with this great State of California, comprehensive as it is, extending many miles up and down this coast, and so well adapted to nearly every fruit that grows, he probably would have varied his essay somewhat. But I want to say on that point, that I feel at home among the fruit growers of this State; there is my interest, and there I like to be. But I also come here as a representative, arriving yesterday afternoon, as one of the State Board of Trade; came here on the invitation of the Chamber of Commerce to visit this citrus fair in this beautiful City of Los Angeles. We were received, and did visit this fair, which is magnificent; and invited to a seat upon the stand, and that we enjoyed very much and appreciated; and while listening to Mr. J. DeBarth Shorb, who delivered the address of the evening, what did we hear? While he spoke beautifully, and said a great many good things, before he gets through there is a direct thrust at the northern part of this State, and if you read the papers this morning you will see his language there. We came here to visit this place and to show our good will, from Oroville and all around, and are told that, if the reports are true, in the northern portion of the country the trees are dying, so extreme is the climate, a statement which is not founded on fact; he was mistaken in his information. And when we come down here, I want to say that I come from the County of Sonoma, the City of Santa Rosa, and there we can produce a great many fruits—the cherry that was spoken of this morning in that splendid essay—where they grow to such perfection; the prune, which no part of the State can beat us in producing; and so we might go on. We do not come in competition; we do not pretend to produce the citrus fruits in competition with Los Angeles, San Bernardino, or San Diego County; hence, our interests are common in building up this great fruit interest, and trying to promote the interests of this great State of California, which has not an equal in the United States either for climate or for the production of fruits. And I speak of this matter to say that it is not in the interest of the fruit growers of this State in promoting its great progress to entertain such sentiments—that one part of the State is in competition with the other. Mr. L. W. Buck, one of the largest fruit growers in this State, and who has paid the most attention to it, I think will agree with me. I want it understood that when I hear those sectional thrusts I am going to enter my protest. This is one State, and we are all engaged in one great enterprise; and I will say here that the fruit growers, using that term in the broadest sense—that the great State of California, when we bring it up to its perfection, as it is, and we all unite upon it—that the destiny of California is in our hands; and we must not be divided, but let us come together and entertain no such sentiments as I heard expressed last night. I hope you will excuse me for the time I have taken.

The President: I hope our friend Mr. McDonald will not give himself any uneasiness. I have attended all these meetings, and there is but one sentiment. The remarks of Hon. J. DeBarth Shorb last night

I did not hear. But that was not at the Fruit Growers' Convention, and we are not responsible for it.

Mr. L. W. Buck: As my friend McDonald has spoken my name, I want to say a word. I don't know but he may feel a little out of sorts at something he may have heard. But I am not. I am glad to see the people of Southern California prosper and sell their property at high prices; because, when they do, some of them will come up north, and we will get a little bit of benefit therefrom. The southern part of the State has been the home of the citrus fruit up to this time. We raise a little up north, but we eat it ourselves, and don't try to ship it. It is somewhat the same way with the deciduous fruits in the southern part of the State. We are not in their way, nor are they very much in ours, and I think there should be the best of feeling here. I don't believe that any man that comes from the cold regions of the north down to this delicate climate we find here [laughter], I don't believe any of us envy their situation. We will go home satisfied with the homes we have got, and we hope they will continue to be with theirs. We certainly don't want to throw a stone at them in any way. Our treatment by the people of Southern California has always been generous. They are a very prosperous people, and I see no ground for a division. The State is not large enough for two, but it is just large enough for one.

Mr. A. Block, of Santa Clara: One or two points in the speech of last night referred to I think should have been omitted. But the same points were made a few years ago by the same gentleman in stronger terms, and I don't think they hurt much. The next year we had quite a large delegation from different sections of the north at the Fruit Growers' Convention of three years ago. I have seen the Wolfskill and other orchards covered with the cottony cushion scale, and it has afforded me pleasure as a citizen of California to know that we have been instrumental in procuring from Australia the means which has given the growers of this and other sections so much benefit. And we in turn will get a benefit from them indirectly. There ought to be no petty jealousies. There is no reason for designating one section as being inferior to another. When we meet we ought to meet as Californians, and I don't believe the people here indorse the sentiments expressed by Mr. Shorb last night. We are in accord with you, whether we come from the northern or southern part of the State.

Dr. O. H. Conger, of Pasadena: I wish to state to these northern friends that I stand here as a representative of Southern California, and say to them that we do not indorse any sentiment from any person or any paper that does discredit to ourselves or is calculated to make a division in this State on fruit culture. We do not indorse it. We have had to apologize to our friends of the north on other occasions for sentiments expressed by a few of our people that the mass of our people abhor. We do not indorse those sentiments, and I wish our northern friends to understand that the better element of Southern California, those who have more generous natures, are sorry that anything should have been said or may be said to create any feeling of distrust of our general feeling of fellowship and good will towards all the people of this State, north and south.

Mr. McDonald: I don't want to be understood as being the least bit offended. I like the people of Los Angeles, and like to see this section grow, and want to see them promote their citrus industry all that is

possible. But I did feel that such sentiments should be corrected, and thought it could be done better through this Convention than in any other way. There should be no feeling between one section and the other. There is room enough for us in all our different departments.

DISCUSSION ON PRUNING, RESUMED.

Mr. Kellom, of Tustin: I would like to indorse what the gentleman has said in reference to putting out peach broomsticks. I believe he is right. I believe our practice has all been wrong. Within the last four weeks I put out a dozen Salway peaches. I went to a nurseryman who does a large business, and who sells trees in all parts of Southern California, and I told him I wanted he should prepare those trees for putting into the ground; prune them as he thought best. Well, he made broomsticks of them, and that is all there was to them. And I believe the argument adduced there by the gentleman is correct, and I think that it is worth coming to this Convention to learn how to prune peach trees when you put them out.

Now, one word, and but one word, about the orange. I think he is equally wrong about the pruning of the orange. He says don't cut inside of the orange tree. Nature has her own way to work, and let her do it. Let it grow as Nature dictates. Now, Mr. President, I have a thousand trees—I have two thousand trees—that I permitted to grow just as he recommends for six years, for seven years, for eight years, and last year I came to the conclusion that my trees were doing all the work on the outside, and I thought they ought to do some work on the inside. I put a man in my trees to prune out the heads, to thin them out, and he took out an immense amount of foliage. It cost me from 6 to 8 cents a tree. I thought it was a pretty expensive job for me, but it tells right away. In the crop that I have this present season I have got oranges enough inside of those trees, where oranges never grew before, more than ten times enough to pay me for the pruning. I believe in thinning out the head of the orange tree.

Dr. O. H. Conger: Upon that point I wish to say a word. I have had fifteen years experience' in Southern California, with the orange and the lemon especially. I commenced upon the doctrine advocated in the essay, and referred to by the last gentleman, to let the tree have its course, and I found it was a harbor for birds' nests, spiders' webs, and every sort of material that should not have any place in any tree. And, moreover, the limbs began to die. "Well," I said, "if the limbs are going to die I might as well anticipate what a little time more will produce—a worthless tree on the inside." It is understood, I believe, that a dry limb carries off sap from the tree as well as the foliage. That being the case, I could not see the use of permitting those dry limbs, or limbs that were producing no fruit and harboring all sorts of pests, to remain; so I cut them out so, as the gentleman has remarked, the balance of the top would have fruit upon the inside, and more or less exposed to the sunlight or heat, and the fruit was valuable. And the tendency to fruit, we know, is to the outside, to the limit of those limbs. Why do they blossom more generally upon the outer extremities of the top? Why don't they blossom as freely inside as out, if it is as natural?

It is not so. And my trees are like an umbrella; they are thinned out, and the fruit is large and much finer than my fruit was when I first began to observe this by letting the inside remain as Nature designed or would make. There is no question in my mind but what the thinning out practice is correct.

As to the pruning up from the bottom, I regard that as conditioned upon the climate and exposure. If I was living in the wake of a strong current of wind, where storms occur occasionally, I should grow my trees lower; I should let the limbs form near the ground; I should head them in in order to make them strong to resist those winds. But where you are not exposed to those winds, I should trim up, at least so as to run my cultivator, as I use no plows to tear off the roots, as one essay referred to. That is like taking off the arm and leaving it without the dressing of a surgeon. Cutting off roots is like cutting an artery in an arm. I use nothing but a cultivator. Plows are a thing unknown to me in cultivating an orchard, because the roots are all through, interlacing, and the cutting of the roots takes away the life of the tree, or the means of supplying that life.

Mr. L. M. Holt, of San Bernardino: With regard to the question of prunning, years ago our best orchardists advocated pruning high, in order to get under the trees in good shape. They have materially changed in our section of the country their ideas with regard to this, because the heavy crops, especially on young trees, are on the lower branches. I refer to the orange. And if a person will take an orange tree from its infancy, make the head of the tree high to start with, he will find that he loses a very large crop in the first few years of his orchard at the time when he needs the oranges the most; and therefore our people have abandoned the idea of high pruning to a great extent, although they do work their trees up somewhat after they get older. We are located at Riverside, just as you are at Pasadena; we don't have any winds. [Laughter.] Our high pruning is on account of the orange crop, and not on account of the wind question.

Mr. W. H. Aiken, of Wrights: In the paper referred to, read upon planting and pruning, I think the writer has taken extreme positions. His experience has been mostly in Wisconsin, where they never did raise any fruit, because I have lived there, and in Missouri, where they have raised some fruit. He has never gained experience in fruit culture in California, especially the deciduous fruits, sufficient to speak with authority upon those questions. The *idea* of planting a tree by burying!—It would become its grave—as he says, by piling the dirt up to the limbs; especially a peach tree. Well, now, if there is any tree that should not be planted deep it is the peach tree. The warm sun of spring of course starts the growth of the peach tree at first. It throws its sap early. So that we see sometimes grafted trees that mature a little later. The early flow of sap from the peach root sometimes comes too early and too strong, so that the tree does not properly assimilate it. A tree, according to my idea, should be planted properly, so that the sunlight of Heaven could reach and warm the root to start the sap. His idea of pruning of course is not practiced to any large extent in California. We have been in the orchard business in Central California for many more years than you have in Southern California, and our orchards of deciduous fruits, of course, are very large; they are very productive and valuable, probably more so than the decid-

uous fruits of Southern California, although I am drawing no distinction from that, as you have not been in the business so extensively and so long as we have. "Train a child in the way he should go, and when he gets old he will not depart from it." So we train our trees as we would children; we endeavor to make them beautiful. We endeavor to make them fruitful; we are anxious to give them the form and the strength to bear fruit successfully. A fine looking tree is a good tree. It is pleasant to look at; its products will be valuable. The young trees in the central part of the State are usually taken from the nursery at one year of age. Many of our large plantings have been from the dormant bud. This can be done if done carefully, properly sheltered from the sun, and from anything that may strike and remove the bud. I last year put out a hundred prunes in dormant buds, and at least not over 10 per cent failed to grow, and made a growth from that dormant bud of from three to six feet. Taking a tree one year, from the nursery, in our warm California climate, I believe the practice is to cut it back from a foot to two feet from the ground, and build the tree from that. Take out each year such limbs as you do not wish to remain, bearing in mind not to allow the tree while young to become too thick with limbs. Just think of how those limbs, when they become large, would look, and how they would fill the tree too full, and how there would be too much bearing wood; the fruit would be small. We prefer to carefully watch and prune the tree into a handsome form, with plenty of bearing wood; not too much. After a tree comes into full bearing, from five to six years, very little if any cutting back need be required. The cutting back of old wood is not proper. The tree will take care of itself, the growth of the fruit will assimilate and take up the sap so that the tree will not become too high, probably, and do well. The allowing a tree to grow from the first setting out without pruning for many years will make it grow out of shape, and it will necessitate heavy pruning just when you otherwise would stop pruning. Then, you would have to use the saw, and I don't know but an ax, to get your tree down into shape; it would almost cease to become a tree; and you would find the fruit would be small, and the tree itself would be unprofitable.

Mr. L. W. Buck, of Vacaville: I find that the old saying is a true one, that doctors never agree, and that is just as true probably with fruit growers of this State as with any other class of doctors. And it is necessarily true, too. The difference of climatic influences, soil, and so forth, makes different treatment necessary in different parts of the State. Now, if I may say a word in reference to what my friend Aiken has said here—he being a northern man, it wont be considered to be sectional; but in some parts of the State, if you would carry out what he says (or, at least, that is my judgment) about not pruning a peach or an apricot (and, of course, all the remarks I may make pertain entirely to deciduous fruits, because I know nothing of the raising of citrus fruits), I believe that they would raise the kind of fruit that you see quoted occasionally in the New York City papers—peaches selling by the quart. Now, as a peach raiser in California, I don't want to raise any of that kind; don't want to raise them to sell, ship, dry, or keep. I want large, fine fruit, and that in the section I live in can only be obtained by thorough and systematic pruning and thinning. Now, we prune our trees heavily even if they are thirty years old, and I have a few that are more than thirty years old; and we prune them just as heavily as

we do a tree that is younger. You have got to give a peach plenty of sun or else you don't get good fruit. Now, the section of the United States that has in years past furnished the dried peach product of the market, has been the northern part of the Southern States, the States of Georgia, Alabama, Mississippi, Tennessee, and South Carolina. And if any one remembers back thirty years ago to the dried peaches that you bought in the market, you will find that they were scraps. They were not to be compared with the dried peaches that are produced by this State. Nor is there any other section of the United States that can put into the market a dried peach product that begins to equal the dried peach product of California. In my section, Vacaville, it is certainly very necessary that you prune, and I always prune heavily from the time the tree is planted. I prune for the first three years for shape; after that for the crop. A heavy pruning saves thinning, and the thinning in our section is equally as extensive as the pruning.

Mr. Aiken: I wish to correct my remark. I intended to except the prune and the apricot, of course. They grow upon the new wood, and they must be pruned as Mr. Buck says, three years. It is strange how men's minds will revert to what they do or know the best. We raise the prune almost entirely, and I was thinking of the prune tree. My friend Buck raises the peach and apricot.

Mr. C. C. Thompson, of Pasadena: If any individual should go away from this meeting to-day and get the idea from the discussion here that the absence of the knife on the first year of his orchard would make that orchard a success, I should consider that the society and all of us had made a failure in our discussion. Order is Heaven's first law, and to spare the knife the first year on the orchard would be certainly, to my notion, the cause of the failure in the orchard as far as uniformity was concerned. It might bear fruit—large fruit. But certainly we can raise good fruit, and at the same time maintain a uniformity in that orchard—order. Why, to see one tree all growing to one side, another all growing to the other side, another tree all growing on the ground, another tree all growing six feet above the ground, certainly to my eye, as to what an orchard should be, that orchard would be a failure. Now, I would like for any man to tell me how I am going to make that orchard uniform without the knife being used thoroughly the first year. Why, I know of no way to control a tree that heads four feet from the ground, and another that heads a foot and a half from the ground, except to take the one that heads four feet from the ground down to the same height as the other one, and strip the other one of its growth in such shape that I may make the buds all come out about the same height from the ground. Uniformity in an orchard is certainly beautiful. I catch these remarks by listening to people traveling along my street: "Why, look across the tops of those trees. It looks like it was sheared with a mowing machine. Every tree looks alike." The peaches are nearly all alike in shape and form, and I believe they are bearing just as fine fruit as though one tree went one way and one the other, and one tree headed high and another low. How is this going to be accomplished without using the knife the first year. I have heard it said in Iowa, "What is the use of cutting off a man's head if his heel is sore?" If there is a lack of root it is certainly necessary to remove a part of the top in order for the root to support the top. If a tree has an abundance of root it will support a large amount of top. I want all the roots

I can get, and then I will risk the top coming without the tree dying, as our friend from Elsinore speaks of. He has raised the idea that it is absolute death to trees if you cut the top off like a broomstick. He is certainly mistaken. I know that from experience; I know it from observation. Out of twenty acres of peach trees I set at one time, I only lost four, and he would say they were like broomsticks. They were, in a measure, but it was a broomstick that was shorter than my wife uses a good deal, and had but few more limbs on than that broomstick has. Consequently, those trees are all about the same height. I allowed about the same number of buds to grow on each tree to form the head, and out of that twenty acres of trees only four died from transplanting.

Mr. Theo. Deming, of Sacramento: Believing, as I do, that these semi-annual meetings are for the purpose of comparing notes and getting all the information we can from each other, and after listening with a good deal of interest to the essay of Mr. Varnum, from Elsinore, I thought, perhaps, it might interest this meeting for me to relate some experience which I have had in an orchard of apple trees, as he alluded more particularly to apples in that essay. I planted an orchard of thirteen acres of apple trees in Lake County. They were about as large as my little finger. I dug the holes rather deeper than I should again if I was planting, and cut off each tree so that there was not a tree in the orchard that exceeded eighteen inches in length. Of course, they were all in a dormant state, and nearly all those trees grew. A few failed to grow, and I found that in some instances the roots had been eaten by gophers, and in others that the tree had sunk somewhat lower than it ought to have been, from the fact that the holes were dug a little too deep; but out of the thirteen acres I don't think more than a dozen died, and to-day I doubt whether there is a handsomer apple orchard in the State. I was very much surprised to hear the statement made in the essay, that the trimming of trees, leaving small limbs, I think, two or three inches in length, would cause their dying. It is a statement that I never heard before. I have been interested in fruit growing nearly all my life, both in Indiana and in California, and all the reading I have been able to do, all the experience that I have heard from others, and my own experience, is contrary to that.

THIRD DAY'S PROCEEDINGS.

Thursday, March 13, 1890.

(President Cooper in the chair.)

FRUIT DRYING.

Essay by J. L. Mosher, San José.

The drying and preserving of fruits is one of the greatest leading industries of our State, and no other industry has so great a future before it.

The words "dried fruits" do not seem to be the proper ones for

expressing the quality of the evaporated fruits of to-day, for they are much different from the old style of "dried fruits" of our childhood. The masses have to be convinced of the superiority of our evaporated fruits, in order to overcome the prejudices of the "dark brown shriveled and dried up article," that has become so famous in "song, jest, and poetry," tough as leather, requiring hours of stewing and boiling to make them palatable, and then possessing but little of the natural taste of the fruit. With an evaporator it does not require any great amount of skill to produce a most excellent article, superior to all other ways of curing fruit, and rivaling as it does the ordinary canned goods. With an evaporator it is very essential to have a draught of air, hot enough to keep the fruit moist, and still carrying off the moisture. The more rapid the evaporation the better the result, both in color and flavor, as the starch, by the evaporation of the water, is quickly converted into sugar. The slower the evaporation, the less sugar is retained in the fruit, and for this reason a cold draught of air should never pass over the fruit. The velocity of air passing through, when drying, should range about nine hundred feet per minute. If the air, loaded with moisture, becomes stationary, evaporation ceases. The temperature should not exceed 200° Fahrenheit.

The fruit should be thoroughly *ripe* before placing on wire trays, and here is the greatest drawback. The acid of the fruit coming in contact with the galvanized wire forms a precipitate of sulphate of zinc, which is very detrimental to the taste of the fruit, and which I believe our customers claim to be the results of sulphuring. Here is an open field for our inventors to overcome this trouble. The results obtained in many experiments tried in my establishment have proved that dipping the trays in hot glycerine is very good, and we are now trying Japan and baking it on the trays, which, I believe, will be the best of anything yet tried. The zinc certainly must be removed in some way or other, or the fruit will be unsalable. Before packing, the fruit should be dipped in hot water for a few seconds, to kill all the germs and insects, and spread out to dry. The advantage in evaporated fruit is, that it can be shipped over the world without danger to its preservative qualities, and at a great saving in cost of freight, compared to the canned goods. In canned goods the fruit lacks ripeness, and sugar has to be added. In evaporation, the fruit can be entirely ripe, and the *natural fruit-sugar* retained while drying; and again, evaporated fruit is a *pure* article, and when soaked in water a short time will resume nearly its original proportions. Taking all this into consideration, evaporation is *the* process of the present.

EASTERN FRUIT SHIPMENTS.

Essay by L. W. Buck, Vacaville.

The California Fruit Union has agents in Omaha, Kansas City, St. Louis, New Orleans, St. Paul, Minneapolis, Chicago, Louisville, Buffalo, New York, and Boston, and the growth of shipments are shown in the latter city. In 1886, Boston received its first fruit car direct from California. In 1888, about one hundred, and in 1889, fully one hundred and

fifty cars were shipped direct from California to that city, and while, perhaps, in no other city will the business show as marked a growth as Boston, the increase has been large to all points. This is due largely to the fact that freights have been reduced, facilities improved, and time in transit very much shortened, enabling the shipper to count with more certainty on the time and condition of arrival, as well as to cheapen the product to the consuming public.

The special train service has done much to accomplish this, as it has generally been the most certain service that we have had, as well as the cheapest; and the advantage of special trains of deciduous fruits can only be obtained by the organization of shipping interests. The buyer must help the grower, and the grower help the buyer, as deciduous fruit must be packed and shipped as quickly as possible after being picked, and much of it must have a quick and certain delivery to points of destination.

I suppose the same is true in regard to citrus fruits in the main, but of that I know very little, as in my section of the State we use our citrus fruits as you people in the southern part do your deciduous fruits—eat them.

The shipment of green fruit to the East has become an important and growing industry. Successful results are dependent upon several conditions, some of which are beyond the control of the shippers, to wit: climatic changes and unavoidable delays in transportation, but much depends upon condition and manner of picking, packing, and boxing, as well as the handling which the fruit receives before being stripped and loaded in the cars.

Too much care cannot be used in handling, so that the fruit may not be bruised in its course from the tree or vine to the car. Fruit should be carefully picked when in proper condition, which should be, with peaches, nectarines, and apricots, fully matured, but perfectly firm; and great care should be used in throwing out all wormy or defective fruit, as well as that which is undersized, as often the sight of one small or decayed peach or pear will make a loss of, perhaps, 50 cents per box on a whole line of fruit when sold at auction.

In the early shipment of fruit from California to the East, pears of various kinds, Gross prunes, and grapes were about the only kinds shipped; but now the peach has become prominent as a shipping fruit, and in all the markets of the East fine, large, highly colored California peaches have become almost a necessity to dress up the various fruit stands, command good prices, and seem to retain more of their flavor than any fruit, except pears.

Whenever the railroad companies will reduce the freight I think they will receive a much larger net revenue, in consequence of very much increased shipments, and whenever that good time comes, I believe California will, to a very large extent, supply the fruit market in the East, both green and dried.

The channels of distribution have been largely extended, and I believe the business is still in its infancy. The time was when growers could sell all their shipping fruit at good prices, but the largely increased orchard and vine planting has changed that, and made it necessary, in many instances, for growers to unite, and load and ship their fruit to the East. This is more easily accomplished through local or neighborhood organizations, which prevent one market from being overloaded,

while others receive none; and could all the shipping interests be united—both growers and shippers—good results would be reached, as without concentration and control the business will certainly be endangered by one party or locality shipping their fruit where it would be sold in competition with that of their neighbors.

The California Fruit Union has been in existence now four years, and, I believe, has accomplished much good. While started as exclusively a growers' organization, it was wisely changed so as to admit buyers as shippers with good results, as the larger the proportion of fruit that can be under our control the better, the weaker the competition, and the more regularly can all the different markets be supplied.

FRUIT DRYING.

Essay by W. N. GLADDEN, Healdsburg.

The importance of the fruit-drying industry to this State, and its probable magnitude in the future, cannot be well estimated. Never before in our State was there a better outlook in the markets for California dried fruits, nor brighter prospects for remunerative prices to the producer, than at present. In the face of discouragements, insect pests, low prices occasionally, and the howls of croakers, who always at such times cry, "I told you so; I told you that the fruit business in California would be overdone," it is indeed cheering and encouraging to see this interest steadily growing from year to year, and to find that these same low prices have, in one sense, proved a blessing to our fruit growers, in that they have been the means of introducing our fruits to thousands and multiplied thousands of mouths in the Eastern States that previously, on account of high prices, had never tasted, and thereby proved the superior excellency of, California dried fruits. This has created a demand which we cannot supply. And the demand will continue to grow with the rapidly increasing population of our country. It is a fact that at this time those markets are almost destitute of our dried fruits, and the cry comes to us, "Send us more."

In view of the situation, every fruit grower in the State should feel encouraged to go ahead in the planting and cultivation of orchards, the extermination of insect pests, and the preparation of our fruits in the best manner for those markets, and indeed for the markets of the entire world. But, now to the point: How to dry our fruits and prepare them for market. On this subject I want to begin at the beginning, and that is in the orchard.

Fruit for drying should be gathered from the trees with the same care as for canning, without bruising, when ripe, but not too soft; then hauled to the drying grounds, or cutting shed, on a wagon with springs; then carefully graded as to size and ripeness. As soon as a tray is filled, place it in the bleaching box, exposed to the fumes of burning sulphur. When dried, keep the different grades separate, and be careful not to dry too much. It should not rattle like bones, but should be somewhat soft and pliable, so as to press in boxes or pack well in cotton sacks. If not boxed or packed immediately after drying, it should be kept in a dark room, or protected by mosquito netting, or other means, from moths.

The importance of properly sorting or grading before drying is not fully appreciated by many who are engaged in fruit drying. I have seen large and small peaches, ripe and green, placed upon the same tray to dry, and the result is uneven drying, whether by natural or artificial means, and when the small pieces are dried to cracklings, the large are not nearly done. Then comes the work of sorting on the tray, picking out the small and dry, and leaving the large for further drying. This is more work and trouble than to properly grade before drying.

And then, such a motley, "measly" mess of it as this mode of drying makes, is not at all inviting to the eye of the dealer. In inspecting such samples, he will reach forth his hand, gather out the small, inferior specimens, the over-ripe, and, if it be peaches, and there should be one dark piece in the lot, he will be sure to find it, and call your attention to what he has found.

As to the mode of drying, whether by natural or artificial means, it should depend much on the locality. Where there is no fog and plenty of hot sunshine, I think it is better to "sun-dry," because about as fair and good an article can be produced at far less cost.

In regard to sulphuring, or "bleaching," as it is called, I have but little to say. So long as the market demands bleached fruit, we will all continue to burn sulphur. As to the process of bleaching fruit with the fumes of burning sulphur, it is too well known to require a description. Properly speaking, it is not "bleaching," but merely "fixing" or "setting" the natural color of the fruit, preventing oxidation. What quantity of sulphur to use for a given space of sulphur box, and how long fruit should remain exposed to its action, are vexed questions which I will not try to answer. I might say much on the subject, but it is not worth while, for nearly all fruit men will be governed in this matter, to a great extent, by their own experience. My practice is to sulphur twenty to thirty minutes, depending on the kind of fruit and its condition. The greener the fruit the longer the time required. All light colored fruits should be bleached. Dark colored plums and French prunes I sun-dry (the weather permitting) without bleaching. After drying, I dip pitted plums in boiling water before boxing or sacking. It improves their appearance and destroys all germs or larva of insects.

I am well convinced that many persons, through great anxiety to make an extra fair and fine article of fruit, bleach too much. Apricots, which look very fine and transparent, will be found to have a peculiar, disagreeable taste, due to over bleaching. I invariably sulphur all light colored fruits, and will continue to do so as long as the markets demand it, but hold myself ready to abandon the practice whenever I can realize as good or better price for the unbleached article. I dry fruit for the money that I make out of it, and all that purchasers have to do is to inform me how they want it prepared, and that way goes. And that is about the way with all of you. The proposition that sulphur-bleached fruit is injurious to health has been discussed pretty thoroughly of late years, and I will not enter that field in this article, and will only say I am convinced that no person will be poisoned or injured in health by eating fruit properly treated by this process.

I desire more particularly to offer some suggestions which may aid us in maintaining and increasing the enviable reputation we now possess in the eastern markets for choice dried fruits.

The time was when it was said of certain inferior fruits, "Oh, they

are not fit for anything but to dry;" and it was really and honestly thought that miserable little green seedling peaches were very good for that purpose; but that time is past, and I hope forever gone.

If we raise nothing but good fruit, there will be no poor fruit dried. Our nicest canning fruit is the very article that will make the finest dried fruit.

In regard to peeling peaches by scalding them in a boiling alkali solution, I would just say: if you cannot, after removing the skin, rinse all the alkali from the peach, so as to prevent it turning dark when dried, you had better peel by hand or with machines. Already this lye-peeling business has caused some mischief in the market. I would like to hear from members of the Convention on this subject. I cannot say that I am in love with the process. From all I can learn, I think that many who used to peel with lye have abandoned it and gone back to machines.

One more thought and I am done; I refer to cleanliness. In all manipulations of fruit in drying and preparing, this is of the utmost importance. Have plenty of good clean water at your drying establishment, and let your cutters (women and girls are the best) wash their hands when necessary; this they will do of their own accord, as a rule. Men and boys are more negligent, and often have to be stirred up on this matter. Keep your trays clean and in good condition. Sprinkle floors and grounds every day, evenings and mornings, to prevent dust from rising and settling on the fruit. Keep it out of the dust and dirt. Remember one thing, you cannot make good dried fruit out of little green worthless stuff fit only for hog feed.

DISCUSSION.

The President: The essays that you have heard read are now before the Convention for discussion.

A Member: Mr. Chairman, in reference to the essay read by Mr. Buck, I, for one, as a fruit grower, would like some further information in regard to the organization he speaks of, which I understand has been in the central part of the State a great success. In Southern California we know by this time that we cannot raise as much deciduous fruit, that is, of peaches, pears, and prunes, especially, as we can find a profitable market for. I find the northern part of the State is far in advance of us in this business. They have had many more years of experience, and have doubtless learned a great many important lessons by experience, and we in the south would be very glad indeed to profit by their experience without having to pay for it as they have, perhaps, by mistakes in the beginning. I would like to learn the details of this organization—when it was organized, upon what principles, whether it is an incorporated company, whether there is any limit to the amount of stock one individual should have in it, and in fact any details of the organization of interest to fruit growers.

Mr. Buck: The California Fruit Union was formed or started in the fall of 1884 or 1885. A Convention was called in San Francisco, of the fruit growers of the State. Prior to that time the buyers had come from the East here and bought nearly all of the shipping fruit, or fruit that

was suitable for shipment East. But in 1885 they failed to do it, and the result was that a very large amount of fruit stayed on the trees and vines, and never was harvested, because the growers were not prepared to dry, and consequently their fruit reached such a condition that it was absolutely worthless on the ranch, awaiting the buyer who didn't come. I think that that was the main motive in the organization of the fruit growers. There was this organization of the California Fruit Union, which, as I stated, was first an exclusively growers' organization. In 1886 they commenced operations, and shipped quite largely; and that year there was also an organization, or a partnership, call it whatever you like, of buyers of the State, which operated against, and shipped in competition with, the organization of the growers, under the head of the California Fruit Union. It was a disastrous year, both to the buyer and to the grower, as both factions shipped largely, and the fruit of one sold against the fruit of the other. There was no knowing how many cars went to Chicago, Minneapolis, St. Louis, or any other city. There was no control; and the result was that in many instances two or three or even five times the fruit was shipped to a certain point that could be taken care of, and the result was a disastrous sale. At the annual meeting of the stockholders of the California Fruit Union in 1887, the by-laws were so changed that shippers might join as stockholders of the Union; as such, without owning acreage. Some of the shippers joined the California Fruit Union, and we succeeded better. We had their assistance, and I think that we didn't do any hurt to them, and they certainly did us some good; and consequently, in 1887, it was smoother sailing. There was not the same loss as there was in 1886. In 1888 and 1889, the same. The average price in 1886 and 1887 I cannot give to you, but in 1888 the average price of all fruit sold through the California Fruit Union, I think was $2 92 per hundred pounds, that is, F. O. B., loaded on the cars. In 1889 it was $3 30, F. O. B. Of course, that does not include the cost of package, or the local charges for loading, and so forth. Now, while of course the prices are not always high, and in fact are often very low, we in the northern part of the State have been forced to this from the fact that the buyers could not or would not put their money behind the whole of the shipping fruit of the State, and the grower was left to the almost absolute necessity of shipping a part of his fruit.

Now, the California Fruit Union was started with a large capital stock, only a small portion of which has ever been taken; it is an incorporated company, association—an incorporation. And it has worked as the head, or moving center of quite a number of local organizations in the State, and, I believe, with very much advantage to the State, as we have moved out a large amount of fruit, and it has certainly brought something—if not high prices, we have got something for it. In 1889, the California Fruit Union and its members shipped, I think, fully two thirds of all the fruit that was shipped east of the Rocky Mountains, and, of course, that fruit was all under the control and management of the California Fruit Union, and the members did not ship to any point where we have agencies, except that they shipped to our agent.

Of course, there is considerable in the detail of the organization that would take some time to explain in full. It is governed by nine Directors, a President, and a General Manager; and we maintain an office in

San Francisco through the winter, and the office is moved to Sacramento in the summer.

Much depends upon the condition of the fruit when picked, and also a good deal depends upon the climatic conditions after the fruit is picked and loaded in the car. I don't care what the condition of the fruit as it leaves California, if it strikes over into the Missouri Valley in one of those hot, wet, sultry spells, it is only sure of arriving at a point of destination in poor to fair order. If, on the other hand, it starts here properly, and the conditions all the way through are favorable, it arrives in fair to good condition. Good condition, as a rule, means good prices in almost any market. Fair to poor means low prices, but little above freight.

There is much to be studied in the boxing of the fruit. The material used should be good, and it should be light, because the deciduous fruits that we ship, as a rule, must be shipped on fast time and high freight, and the California Fruit Union have certainly accomplished considerable in getting the time that we are now receiving from the railroad company. While we have never received as low a rate of freight as we would like, and as probably we will get when we, like you in Southern California, have a competing line of railroad, we certainly can ship, and do ship, a good deal of fruit, and get something for it. I was shown a basket here, which I think a very good one for the shipment of small fruits. By small fruits, I mean grapes, small plums, and apricots. They are shipped from the north in a basket like that, in a crate containing four or eight, as it may be single or double; and there has been a good deal of improvement on the weight and style of basket made. I think it is made here in Los Angeles, if I am not mistaken; and I understand that W. R. Strong & Co., of Sacramento, have, or are going to have, it for sale up there, and, judging from the sample shown here, I think it is a very desirable one. And while I say that I am not here to advocate or advertise any particular basket, only the lighter the box, the lighter the package, and the cleaner it is the better. Not only is that true of the basket but of the box.

In the northern part of the State we have quite a number of local organizations.

Large apricots should be wrapped, because they are too large to be packed in one of those baskets. In packing small apricots and plums we use a long strip of paper that makes three pieces about the size of this basket. If it is used as a long piece, we lay it in the bottom like that, and lay in a row of apricots or plums, turn it back between the first and second tier and lay in a tier, then turn it back and lay another one, which should fill the basket, and then the strip should be long enough to come back over the basket. If you should use a strip of paper, it should be long enough to lay in on top of the fruit. We use different sizes of boxes. The pear, the apricot, the plum, and the peach box are all of the same size, the only difference being in height. And, commencing with the earlier and smaller fruit, they use usually the four-inch box; then, as you come to the larger varieties of peaches, increasing up to six, although there are not very many six-inch boxes shipped. Four and a half, five, and five and a half inches high is the usual peach box. A four-inch box, or a four and a half, is a plum or apricot box, holding about twenty pounds in all cases. A pear box, I think, is nine inches, holding fully forty pounds when packed a little

more than full, so that there is a little bulge in the box. Grapes are packed in either single or double crates, of about twenty pounds net to a single crate, or forty pounds net to a double crate.

It should be packed in all cases so as to avoid any shifting of the fruit in the case or package. With the peach you should avoid much pressure. And the box question is easily fixed, because if your box is not quite high enough, instead of putting your cleat on top of your box you put it on the under side of your cover, and in that way you raise the cover about three eighths of an inch.

About two thousand four hundred carloads of green fruit have been shipped to eastern markets during the past year. The dried fruit I can't give, but it has been a very large amount. I was talking with J. K. Armsby, in San Francisco, a few days ago, and as he is one of the largest handlers of dried fruit in the country, his remarks ought to be good authority. He said, that this year California had shipped East about sixteen million pounds of prunes, as against six million last year, and that not only the demand, but that the price had been very much better this year than last. He also said that the canned fruit market was suffering on account of the dried fruit, or rather, that the dried fruit of California had become so good that it was taking the place of canned fruit. I asked him if any other section of the United States was making the same improvement that California was, and he said no; that California was the only place that had made any improvement except a few places where they had started evaporators in Delaware, and a few other places, and they were not operating on a very large scale.

The reason that the budded prune, or the prune of commerce, is valuable and salable, and the fruit which sells more readily than any other dried fruit that we have, is the fact that it is a sweet prune. Poor people, people of medium circumstances, can buy a dollar's worth of dried prunes without buying two dollars' worth of sugar to go with them. Now, when you take a Hungarian prune, it makes a very sour dried fruit. It is a dried plum, not a prune. I don't believe a man would ever venture to dry them when he could have got the price for them that he could this season or last. The Tragedy prune is one that has gone to the front with a great deal of popularity as being a very early and a very sweet prune, and has brought exceedingly high prices. How long it will do so is more than I can tell, but that is the present status of the Tragedy prune. It is not raised to any extent except around Sacramento, and last year some twenty-pound boxes sold for $4 and more per box in the East. It is a good sized prune. It does not compare with a large Hungarian, but then it is a fine, large, sweet plum, or prune, or whatever you have a mind to call it. Quite a quantity of the Kelsey plums were shipped East last year, and they were not appreciated particularly. I don't know why. They did not sell as well as fine Hungarian or Gross prunes.

Mr. Aiken: It is well known that the prune tree is a hardy tree; it will grow, as far as the tree is concerned, in many portions of the State. There are portions of the State that have been proved, by a series of years, to be well adapted to the cultivation and growth of the prune. And yet prunes grown in several localities of the State are very indifferent. Prunes grown in sections of the State where a long season is allowed for their growth and proper ripening, produce a fruit of rich, fruity flavor,

and a fine bouquet taste—a prune that grows large and dries heavy and brings the very highest prices in the eastern market. There are other places where the tree will grow where it apparently bears a crop, but it is found after the prunes are dried that they are substantially skin and bones, without this fruity flavor or bouquet; without the rich, dark, glossy color that indicates that the prune has ripened naturally, and fully ripened before drying. Such prunes bring a very low price in the market. I remember two years ago, at Chico, a gentleman brought me prunes, apparently French, saying that the San Francisco buyers would not pay for them, would not buy them, and asked me what the difficulty was. It was apparently a prune. It had grown upon a French prune tree. The trouble was it was grown in a location where the severe hot climate of the valley had caused the prune to shrink and shrivel, and fall from the tree before the natural ripening process had taken place. It consequently was small, and very thick skinned; it was difficult to bite it, containing, as it did, none of the proper juices that the prune should have. Therefore it was unsalable.

Now, while our friends in Southern California may grow prunes, I fear that year by year it may (in a cool year) prove somewhat of a success, and in a very hot and dry season would prove a failure. These things would have to be studied carefully: the elements of the soil, the exposure to the winds, the exposure to the fogs of the ocean. There are places in Sonoma County and in Santa Cruz County where prune culture we would suppose might be carried on, where, owing to severe winds of the coast, they crack open and make a very poor, dried prune, and, indeed, the culture is a failure. I have heard of several such localities up and down the coast. One gentleman, I think from Ventura, being near the coast, spoke of that as a fault. It is a fault that cannot be corrected. In Sonoma County, in the upper part, Santa Rosa, and above there, they raise a most excellent prune. It is a cool climate, and the fruit ripens with an excellent flavor. The same I can say of Santa Clara, and portions of Santa Cruz County. They at present are the prune centers of the State, and probably will remain so; while in these new portions, in this new orchard enterprise of Southern California, there may be places where the prune will do well. I hope they will. There is a vast field, as Senator Buck has stated, for the dried fruits of California and the prune. I don't think there is much fear of overdoing it. At my point on the Santa Cruz Mountains, in Santa Cruz County, near San José, we have this year a rainfall of eighty-five inches. To mature a prune, large, rich, and juicy, without a rainfall, almost you might say an excessive rainfall for Southern California, I do not believe that year by year, dry and wet, that prune culture will be a success. I do hope it will be, but from my long experience in prune culture I fear it will not be. I throw these matters out for your consideration in setting out orchards in Southern California.

Mr. O. N. Cadwell, of Carpenteria: I do not believe that the prune can be successfully grown along close to the ocean between my place and Los Angeles, or even San Diego. I believe there has been a great deal of money thrown away in prune trees for our locality. In the valleys, or away from the coast, it may do to plant prunes; but for twenty-one years, take the time together, the raising of prunes would have been a failure at my place. The plums generally do not do as well as they do further north. I have been in the fruit culture in Lake

County, where they can raise good plums, and good prunes, I presume, too, but good plums I know do grow there. We can raise good plums now and then where we live, but they are not a success.

Mr. A. Block: There has been quite a discussion here in reference to the French prune. Will you allow me a suggestion? We all look to the Frenchman for characteristic pride. If a Frenchman goes to buy meat, he wants to buy it of the French *butchaire*. He says no American can cut meat as the French *butchaire* does. When he buys his bread, he wants it from the French *bakaire*. I, for one, admire his doing so. Yet, as a Californian, as an American, I would prefer that he should go to the American and to the Californian. I have some pride, and I hope that California will assert a pride of character and drop the name of the French prune. Let us call it the California prune. [Applause.] And I hope that hereafter the discussion will be in reference to the California prune. If I am in order, I move that this Convention recommend to the fruit growers of the State to adopt the name of California prune, whenever the name of French prune is to be mentioned.

The motion was seconded.

Mr. McDonald: That is really a suggestion of great importance, and has been discussed a little heretofore; and I will agree with Mr. Block if we could get together and drop that name French, and call it the "California de Ente," or the "California de Sergent," or any other Sergent. Only if we can get the name and leave off the French, and have it distinctly California, I think it would be better. And right through this Convention is the place that we are going to make the change, if we can make it, so it will be universal throughout the State. I will join Mr. Block in any effort we can make in that behalf, if we can get at it intelligently and so it will not mislead; but we must do it so it will be known throughout the State.

A Member: I want to testify that the California prune is already known throughout the East, and the French prune is really a drug on the market if the California prune can be obtained. I have had some experience in regard to that. Drummers in New York selling prunes have told me lately that the French prune is a drug on the market, and that they always call it the California prune. There are French prunes standing on the shelves all over, and they can't sell them if they can get the California prune. One reason is that the California prune is sweeter.

A Member: We ourselves are using the French name, and putting it on the boxes. They are marked "Twenty-five pounds of French prunes, packed by John Jones, Santa Rosa." Now, let them call it "California prunes, packed by So-and-so, California."

Judge Aiken: Mr. Chairman, the French do not call their prune the French prune. It is not put upon the market as the French prune. There are the De Ente, as well as others. That is the name of the prune upon all boxes and jars that come from France. Not known in the market—not rated—as French prunes. For a matter of convenience on this coast we have fallen into the error, I admit. Simply because certain cuttings or certain trees are brought from France we have called it the French prune; and we have called it the Petite because it is small. But that is a misnomer. It is not always small. Where it does well it is a large prune of its kind. It was originally a date plum, properly speaking, I presume. The French call plum a prune, and it is a date

plum—a plum that will dry with a pit in it. I have always said that the difference between a plum and a prune is, that a prune would dry well with a pit in. I rather agree with my friend Mr. Block, that if we could agree upon some name it would be well to drop the word French. Felix Gillett, a prominent prune grower in Nevada County, suggests the "California de Ente." The French simply name theirs De Ente. Now, if we could go into the market with "The California de Ente," which is proper nomenclature of the prune, it would be a suitable and an exact name. It would define the kind of prune, and it would come directly in competition with the prune that was sent from France under the same name. We simply add California to identify the prune. And I would amend Mr. Block's motion so as to make it identify that particular prune by using the French name De Ente—California de Ente.

Mr. Block: While I appreciate the effort of my friend in designating it, I hope that you will drop the De Ente. Prune is an American name, good enough for us. I want American names on all occasions. With regard to the description, De Ente, you have given it correctly. Why, you have got prune De Ente, prune Petite, prune Robe de Sergent. Let us call it California prune, and then if you want to designate what particular name it has, add that to it. But let us call it the California prune. Let us recommend to all the growers, instead of marking twenty-five pounds of French prunes coming from California, mark it "Twenty-five pounds of California prunes." That is plain; that is the English of it. Let us drop all foreign words.

Motion carried.

DISCUSSION ON FRUIT DRYING, RESUMED.

The President: The discussion on selecting, preparing, and packing fruits is still before the Convention, and I beg leave to suggest that the questions asked by the gentleman from Pasadena, with regard to whether it is necessary to wet fruit with hot water to prevent eggs of the moth from hatching, is unanswered.

Mr. Thompson: I ask whether it is necessary after the fruit has been dried in an evaporator, if it is packed immediately, or how it is kept free from the dried fruit moth.

Mr. S. R. Thorpe, of Ventura: It is not necessary if you put your fruit directly into cotton sacks and place where the moths will not have access. I will state, too, that the essay may be misleading in regard to dipping some fruits. If you dip your prunes in hot water or any other water after you have dried them, in order to soften them up to put them in boxes, you will get a product so black and so foul that you cannot sell them. If you will put your prunes dry into cotton sacks you will never have trouble with them. I have kept them that way over two years. I have put them into boxes after dipping them in scalding water, and in six weeks' time I have had a mess I could not sell. That has been the experience of others in the evaporating business.

Mr. E. A. Rogers, of Santa Rosa: The dealers would not buy my prunes unless they were dipped. They are better to look at. But for the eastern market they didn't want them. Men would not take them if they were dipped, while I found the local market of San Francisco

wanted them dipped. Three different times there they would not talk of buying unless they were dipped.

MR. BUCK: I do not want an idea to go out which I do not believe to be correct, and that is that dipping fruit after it is dried spoils it. It certainly does not. And there are very few prunes, unless they are packed as soon as they are in the proper condition, that are not dipped by somebody, whether it is the dealer in San Francisco or the dealer on the other side of the Rocky Mountains. They are dipped to make them soft so that they will dry well. Over-dried fruit does not appear well, does not sell well, to anybody. Of course, fruit may be dipped too much, and be too wet, so that it will be in the condition this gentleman says, almost rotten. I have seen plenty of it. It can only be successfully done by experimenting to a certain degree, to see how much moisture you can retain in the fruit after you have dipped it. You have got to dry it out again; that is, the most of it. The manner of dipping by most fruit driers is to dip in a kind of basket submerged in hot water, taking it out and pouring into a pile and letting it stand twelve or twenty-four hours until it dries out; and if you don't get too much water in the fruit as it is dipped in the basket, you won't have any trouble with your fruit spoiling.

MR. THORPE: I was speaking of the apricots, principally.

MR. THOMPSON: I have been taught, and have practiced the teaching, that we could not produce a first class prune without a second course of treatment. What I mean by a second course is a scalding process to kill the germ of insect life, and also to give the fruit a gloss to please the eye of the American man, which is very fine and nice on fruit preparations. Those things had to be done in order to get the fruit desired in the market. What I meant by the question I asked is this: I have steamed peaches after drying and dipped them in hot water after drying, in order to kill this germ, and I have not been satisfied with either, from the fact that it colors the fruit. But at the same time I have been informed that dealers who buy fruit are in the habit of steaming it before they pack it, where they buy it in promiscuous lots. Now, as to the curing of the prune, I don't know whether I have made a success of it or not. I sold my fruit to Germain this year, and he says: "You are the only man in Los Angeles County that knows how to dry a prune right." That is the exact words of the foreman. Certainly, as long as I have got his credit, which ought to be pretty good, I don't want to abstain from dipping my prunes unless that is the latest thing since last fall. I got 8 cents for my prunes. The course I give is a treatment with lye, and then a treatment of glucose in water, scalding or boiling hot, after they have been sweated a reasonable length of time in a sweatbox, and then exposed to the sun an hour or two, and then pack them before they are exposed to insects.

JUDGE AIKEN: On this dipping of prunes I wish to hear from a gentleman present who has been probably the most successful prune drier of the State. Mr. Mosher, of San José, is here, and he has put up, as I think, some of the best prunes in this State.

MR. MOSHER: I don't know that I can say anything new in regard to the curing or dipping of prunes. My process for dipping has been one pound of glycerine to sixty gallons of hot water. I think next year I will use less glycerine.

A MEMBER: I think the best success I have obtained with prunes was

putting them in the sun until two-thirds dry, and then putting them in my evaporator and finishing them. This gives them a very nice gloss, and I think they are the best prunes I have had.

MR. THOMPSON: The eastern buyers, one gentleman said, don't want them dipped until he gets them in his possession. One man in Los Angeles, that I presented my peaches for sale to last fall, said, "Oh, your fruit is entirely too green; we can't handle such fruit as that at all." I told him there was no objection made by anybody else on account of the condition of the fruit. "Oh, well, we can't handle that at all; too green." I said, "You are the first man that I have heard say anything of that kind. Now I am going to tell you the reason you don't want them; you wont tell me." He said, "We want them dry so that they will rattle." I said, "Yes, you want to take the life out of me, every drop of my blood out of me; dry me out entirely, and then take it and add the juice to it yourself, and put it on the market and get all there is in it; and I don't want that kind of thing. I want to sell my fruit so I get the benefit of some of that weight. I don't want you to get them all dried out, and put the weight in and get the benefit of all that yourself." That is the reason they don't want it dipped.

MR. MOSHER: I will state to the gentleman, that after they are dipped I put them in a bin, and leave them there for several hours—four or five hours; not too long. In this pile they get very hot, and I watch that they don't get too hot; and then, after they get through this little sweat, I spread them out and let them get dry enough for packing. They dry very quickly. I bought some dried prunes, that were quite dry, this year from neighbors, and by that process I found they gained about one half of the grade. They probably after dipping would only go sixty-five or fifty-five; they grade them sixty and sixty-five. I have not had any experience with glucose.

DR. J. P. WIDNEY, Los Angeles: I am a fruit buyer, not a fruit grower. It may be I shall speak about something that was already covered in the paper, but I would like to call your attention to one or two points. The points are these: that it seems to me enough attention is not paid to the proper drying of fruit and putting it upon the market in proper shape. I expect, after years go by, we shall find that dried fruit is of more value to this State than oranges. The orange belt is small, while the belt that will produce apples and peaches is almost unlimited, and in the aggregate I expect that dried fruits will be our most valuable product. In going into the market to buy dried peaches they simply call it dried peach, good, bad, and indifferent; there is no discrimination made. There certainly must be a vast difference in the varieties of fruit that will make a good dried peach. As it is now, I think in a fruit orchard they dry everything mixed together, at least they come so in the market, and we have a very inferior article. In the orange culture we are selecting varieties. In the drying of peaches or apples, it seems to me that to make the best result the varieties should be marked, and they should be kept upon the market, not as dried apples, but as the dried Bellflower or dried Pippin, naming the variety, and the producer will soon find it is desirable to do so. So with the peach. Therefore it seems to me there should be a discrimination in varieties.

In the next place we have learned that a dried grape is not a raisin, that a dried fig is not the fig of commerce. There is a change which takes place in the curing. Most of the fruit which I buy in the market

is simply dried—dried until it is burnt up. It seems to me that there might be developed in the peach and in the apple, by a proper system of curing, very much such a superiority as we find in the cured grape as compared with the dried grape; and yet we haven't got it in the market. It may be you gentlemen are doing your work better, but we don't find it in the market.

I find one article that has been cured which is eatable, and another article which has been dried and is uneatable. Yet the two are put side by side, with no distinction, and marked at the same price, and I take my chances in buying. I have found in my own household that the sun-dried article is far superior to that which comes from a drier. It seems in the rapid drying there are lost some of the properties that are retained by drying in the sun.

It seems to me that if these three points were observed that the dried peach and dried apple would become a much more important article of commerce than it is to-day, and pay the fruit grower much better prices. I give these suggestions as a fruit buyer, rather than a fruit grower. I hope that those of you from the northern part of the State will not go home with the idea that we can't raise prunes in this part of the State. Thirty miles south of here we have an orchard of five thousand trees (prune orchard), a mile and a half from my home. Those trees are young. They bore a little fruit last year for the first time. They look well and very promising, and if I were called upon to state the four fruits in Orange County, the infant county of the State, for profitableness or commercial value, I would say the orange, second the walnut, third the prune, and fourth the olive. Why, it is astounding that we have raised this year sixteen million pounds of prunes, and last year six million pounds. The California prune in New York and Boston to-day runs from 1 cent to 1½ cents per pound higher than any Mediterranean fruit; and the time, in my opinion, will soon come when we will rule out entirely the foreign prune; and whether we call it the California prune or not, we will have in the United States nothing but prunes raised in California.

MR. BLANCHARD, of Santa Paula: I dislike to see anybody engage in any business or other enterprise and not make a success of it. I will take a few minutes, and state more fully than I have the reasons for what I have said. Mr. Louis Pellier was the first prune planter, perhaps not in the State, but in San José. When he came there he was a miner. His neighbors laughed at him planting those prunes. They proved to be a great success. I came down in 1872 into Santa Clara Valley, Ventura County, where George P. Brigg came in about 1861 or 1862, a great fruit raiser, from near Marysville. He had an idea that by going down into the southern part of the State he could get fruit into San Francisco much earlier than they did in the Sacramento Valley. He bought a large tract of land, and set out a large number of trees of many kinds. His experience was very disappointing to him. He found that many kinds of trees would not leaf out until midsummer, and instead of getting fruits into the market earlier than from the Sacramento Valley, they were very much later. Disgusted with his enterprise there, he droppd it and left. We used to compare our rainfall with that of San José, Santa Clara County, and for the first ten years it was almost identical, averaging about fourteen inches in San José and fourteen inches at the point at which I was living in Santa Paula,

Santa Clara Valley. I first thought that the reason many of the northern fruits, the plum, the cherry, the gooseberry, and the currant would not grow there, was to be found in the soil. But occasionally we had a season when the cherry trees would bloom full. Then I was convinced, and I think I am right, that the difference is in climate, and not in soil. I have seen two or three times, in the Santa Clara Valley, a cherry tree not as full as I ever saw them in the mountains or Sierras, but I have seen quite a pleasant sight of cherries. But they are exceptional. I have classed the prune with the plum, but the places where they would do well in the south are an exception. I have discouraged those with whom I have been brought in contact and talked about planting fruit trees, from planting prunes. For, as I said, I don't like to see money wasted in any enterprise. The plums that come to us are the plums, perhaps, that grow in Japan, and those generally do well in Santa Clara Valley, Ventura County. But the prunes, so far as I have observed, in Santa Barbara County, and in our county, as a rule do not do well, and do not pay to cultivate.

A MEMBER: Mr. Blanchard's views and mine agree exactly as to prunes and plums. They are not a real success on the coast from Santa Barbara this way. I wasted money in the prune business I never recovered. There may be a heavy crop of prunes this year—trees promise now that they will come out promptly, also the plums—but they are not a real success. We can raise a few nice prunes now and then. Sometimes two years in succession our trees will be full; now and then they will be so full they will all break down if they are not thinned out. In consequence the prunes are almost worthless. They do not blossom or leaf out as they should. They wait along sometimes until July or August before they start a leaf, and sometimes I have seen plum trees that have made a growth of four, or six, or eight feet even, the year before, that would not start a leaf for the whole year, and then come out smiling the next season. It is not the soil that does this, it is something in the climate that we cannot explain.

A recess was then taken.

AFTERNOON SESSION.

(President COOPER in the chair.)

OLIVE CULTURE AND CITRUS FRUITS.

OLIVE CULTURE AND OBSERVATIONS ABROAD.

Essay by C. F. LOOP, Pomona.

As the palm in tropical regions is regarded as peerless, so in the higher zone or semi-tropical belt, the olive stands preëminent in importance as soon as we can understand its marked characteristics, utility, beauty, and longevity.

In the first bulletin issued two years ago by the State Board of Horticulture, in a prefatory note we find this statement: "The olive is now

more prominently before the people of California than any other tree." This is, without doubt, a fact. Fruit growers from the north to the south are reading, studying, and watching the result of importations already made and those which are being made, and the fruiting in this State of the new varieties brought from the Mediterranean.

It is to deepen this interest already created by the publication of the Board, and to aid those who are asking for information concerning these new varieties mentioned in the first bulletin,* that I have prepared this paper.

The assertion with regard to the importance of the olive we reiterate then without fear of contradiction, for its real value to man was understood and acknowledged in the beginning of human history. It was accepted as one of God's best gifts for man's comfort. From this point of view it is frequently mentioned in the sacred writings. And being associated with the customs and sacrifices of the Hebrew religion, it became to the inhabitants of Palestine an emblem of peace, strength, and plenty. In reading Greek mythology our interest is awakened when we find the olive invested with a divine origin, Minerva causing it to spring from the ground.

A Roman writer of an early age places the olive in the front rank, calling it "the first of all trees." Pliny says the vine alone is worthy of being compared to the olive.

Another evidence of importance of the olive is the extent of the plantations made in the early ages, and the continuity of vegetable life and cultivation in those plantations. Go to Antibes, a place between Connes and Nice, on the Mediterranean. Here you find the ancient Antipolis of the Greeks, and some of the most remarkable monuments of Greek and Roman occupation in past ages.

These ruins, the poet says, are shadowy with the remembrances of the majestic past, the dust of decay giving only echoes of the anthems of old victories. Looking away from the ruins your eye is delighted as it rests upon the olives brought by the Greek colonists, covering the fertile hillsides as far as the eye can reach.

Go to Tivoli, a few miles beyond the outer walls of Rome; there you see the foundations of Adrian's Palace, Macaenas' Villa, and the shattered columns of the Temple of the Sybil mentioned in the writings of Virgil, the Latin poet. Overlooking these extensive and magnificent ruins stands a group or plantation of olives whose history, tradition says, is not only interwoven with these relics of antiquity, but also with the history of the Eternal City itself. And to-day you find larger plantations on those purple hills than at the period of her history, when, in the zenith of her power, imperial Rome ruled the world.

Go to the Garden of Gethsemane, near Jerusalem, and look upon those majestic trees, beneath whose shade angels, with silent tread, ministered to the world's Redeemer. The Temple of Solomon, the palaces and towers built before and after the Roman conquest, are all in ruins, while these olive trees, claiming the attribute of comparative immortality, remain as witnesses to intensify the truthfulness of the events which have entitled the place to the appellation of the Holy City.

Monsieur de Candolle, a French writer, has made interesting research concerning the olive among the Hebrews, Arabs, Greeks, and Romans, and in his report has given us a credible account of the manner in which

*"The Olive in California," by B. M. Lelong.

this tree has been carried—as the star of Empire has led man westward, around the world, where climatic conditions favored its growth and cultivation. It is evident, he says, that the olive existed first in Syria and in Greece. There the oil was first extracted, and the original varieties were cultivated under distinct names. The Hebrews and the Tyrians, and afterward the Arabs, carried it along the coast, while the Greeks, and after them the Romans, carried it along the opposite shore of the Mediterranean, leaving in Spain and Portugal a mixture of Greek and Roman names indicating two distinct importations. The ancient Romans, it seems, had ten varieties of olives. Three of these are mentioned by Virgil, and Pliny gives us the name of one, making four. One of these, called in the French catalogue Columella, has come down with very little change even in its name.

As new colonies were planted along the shores of the Mediterranean, and new settlements were made in the interior valleys, varieties were multiplied by trees grown from seeds; and as they differed from the parent stock in color, size, shape, or in the appearance and habit of growth in the tree, each received a new name. In southern France more than fifty varieties are under cultivation now. While in Italy, from Lombardy on the north, including the Island of Sicily in the south, there are three hundred names given in the different localities, and about one hundred varieties found having some special mark of difference. It was perfectly natural to give a local name tó a new olive originated by a family under new conditions; hence, we find the name indicating the color of the fruit, as Verdale, Rouge, Blanche, Pigale, or from its resemblance in shape to something familiar, as Manzanillo, or the Uvaria, having the fruit in clusters like the grape.

But let us take a nearer view of the olive where it has been in cultivation from time immemorial, especially those varieties now fruiting in California, in which we are deeply interested.

Arming ourselves with letters from the American Minister and Consul-General, in Paris, to the Consuls of our Government on the Mediterranean, we left the French capital one bright summer morning, traveling by rail south in the direction of Marseilles. Sitting in our compartment, and moving at the rate of forty miles an hour through a country which has been under the hand of the husbandman, the gardener, and the horticulturist, for two thousand years, aided in their work by a fertile soil, bright sunshine, and summer showers, we were greeted by point after point in landscape gardening rounded into beauty, as the exciting panorama moved before our eyes. One point of interest worthy of mention here, was the palace and lovely gardens of Francis I, where originated the luscious grapes known in California as the Casselas de Fontainebleu.

After midday we passed the divide between the headwaters of the Seine and the River Rhone, entering the Valley of the Ouche, bounded by the slopes of the Cote-d'Or, whose sunny vineyards, before the advent of the phylloxera, were famous throughout the world. To become owner of one of these Cote-d'Or, Baron Rothschild paid a sum equal to a king's ransom.

Passing through the richest part of Burgundy, in districts surrounding Dijon and Macon, we were able to notice the great damage caused by that fell destroyer, the vine pest. Some of the plantations appeared as though fire had passed over, destroying all verdure and life, leaving

in its track desolation and financial ruin to the owner. It is not regarded as an evidence of weakness when the native of Burgundy is seen shedding tears over the dimmed glories of the Cote-d'Or, or the impaired beauty and value of the Clos-Vougeot.

The vine growers in California during the last three years have been able to understand this misfortune, and to join in the wail of grief arising from the heart of the people of southern France over the destruction of their valuable and beautiful vineyards.

My guide book gave me no intimation, and my landlord at Lyons could not tell me just where to look for the first trees in the olive belt; but gave the assurance that before the day was done I would see olive trees enough to cause perfect satisfaction, even if I had traveled six thousand miles in the quest, and were as anxious as Jason in search of the golden fleece. I was, therefore, not a little startled on rounding a curve among the red hills, in the vicinity of the ancient City of Avignon, to gain my first view of that wonderful belt which is coextensive with the shores of the great sea. It was not only interesting but exciting to begin my observations and study among olive trees covering the hills and valleys over which Hannibal led his army into Italy, and where, as I moved from point to point, monuments were seen of the age of Julius Cæsar, indicating the political jurisdiction of imperial Rome.

But having now reached the border of Beulah Land, and begun in earnest the work which I came to do, I will use, to a certain extent, the notes taken upon the ground during many succeeding days and weeks, in and around the centers of this industry in southern France and Italy.

My first observations, as I said, were in the northern limit of the olive belt of southern France, in latitude 44 degrees north. This line on the Pacific Coast would pass through the middle of Oregon, and, if continued eastward, would pass through South Dakota. They have certainly an advantage in temperature, owing to the disposition of the regular aerial currents and the conformation of the shores of this great sea; and as the beginning of human effort in the cradle of civilization was in countries upon its shores, we may pardon the belief still held by the inhabitants that the Mediterranean is the center of the world. If you express a doubt upon this point, and attempt to give them an idea of the aggregate of human interests towering upon the Western Continent, they will at once refer you to the location on the Riviera of the Garden of Hesperides, and you gracefully yield the point without argument.

The local name of the olive which I found near Avignon was the Rouget. The oxide of iron in the red soil evidently gave the fruit its color and its name. The limestone cropping out freely on the hillsides shows the source of nutriment for its wood and leaves. According to local report, this olive withstands the cold incident to this location, and the winds which are at certain seasons exceedingly disagreeable. Like the Mission olive with us, it yields a good quality of oil, and is prepared and used on the table, and this, with its variations, the Caillet Rouge and the Verdale, are cultivated in situations exposed to cold along the limit of the belt. Hardiness and a firm growth of wood are essentials in such situations. In warmer localities, and nearer the sea, in the Department du Gard, and in the country surrounding Arles, where the extensive plantations give a marked character to the scene, we found a number of varieties. Among these the Picholine has a prominent place

on account of its productiveness, resistance to cold, good quality of oil, good table fruit, and its comparative freedom from insect pests.

The tree here, where it originates, is of ordinary size, with straight branches, fruit of good size, terminating in a point, leaves a beautiful green. This tree takes its name from Sen. Picholine, the horticulturist who produced and called attention to it as a distinct variety.

There are about a dozen of the old varieties cultivated in the districts and provinces of southern France which give satisfactory results in quantity and quality of oil. One, extensively planted in the country surrounding Toulon and Hyeres, which, in the estimation of competent judges, gives the finest oil in the world. In the French catalogues this olive is called the Cayon. It was brought to France originally from Genoa, Italy. It offers the great advantage of rapid growth, with little difficulty as to choice of soil, bears early, and yields regularly a large crop of fruit. This has been imported under the name of Rubra, and gives promise of sustaining its European reputation when transplanted to our soil.

Another variety growing in the same districts, under the local name of Le Brun, so named from its dark or blackish colored wood, has been imported under the name of Atro-vialacea. This tree is of slow growth, attains great size, resists cold, requires a good soil and cultivation, fruit firmly attached, so that it does not fall easily from the effects of the wind, which is sometimes very severe in the winter when the fruit is ripe. The oil is yellow in color, very rich in quality, and is always in demand.

When asked to name three olives growing in southern France yielding the finest table oil, Monsieur Audibert, a noted horticulturist connected with the national gardens of acclimatization at Hyeres, named the Rubra, Atro-vialacea, and the Picholine.

Another olive in the front rank, extensively found in plantations along the Mediterranean, in the neighborhood of Nice, Villefranche, and San Remo, and in the interior as far as Grasse, is the Pendoulier. It takes its name from the drooping habit of its branches. It attains a great height, and throws out long branches on every side. It is the largest olive tree now in cultivation in southern France. Like the Cayon, it yields a good crop in alternate years, which is the rule in the olive belt everywhere. The fruit matures slowly, black when quite ripe, and yields a fine quality of oil of light color, without flavor of the fruit, and without odor, and on this account is employed as a vehicle for perfumery. We have also imported this tree under the same name which it bears at Nice, and the time will come when the oil obtained from it will be in demand here in California, when flowers will be cultivated here in large plantations, from which the delicate perfumes of commerce are obtained.

In Italy, as I said, there are a great many kinds of olives, but only about ten or twelve varieties which possess special interest for cultivators in California. Those known as the press olives, grown on the warm, fertile hillsides and plains of Tuscany, producing the celebrated Oil of Lucca, which, before the day of adulteration began, was unrivaled in the Italian market, possess a deep interest for us, and if we can transfer from Tuscany to California the Razza, Leccino, Morinella, Belmont, Rosselina, Grossajo, and a few others for table use, and with careful attention with regard to soil, climate, and location, produce

similar results, I think we shall be doing a good work in our day and generation. Our methods of propagation now enable us to multiply rapidly, so that in a few years the nurserymen of California will be able to supply the demand for young trees which will be adapted to each location, from San Diego to the foothills of Mount Shasta, where it is desirable to plant the olive, and to intelligently recommend the varieties which will give the best results in oil and table fruit in each locality. If I am not mistaken, about twenty varieties, including those recently imported from Spain by Mr. Rock, of San José, are now growing in different counties of California. Last year I imported six varieties from southern France—three for oil and three for table use—and by the end of this year we expect to have fifty thousand plants rooted in the greenhouse. This year I have imported from Tuscany, Italy, ten varieties—six for oil and four for pickles.

Of olives imported from France, we have: For oil: Rubra, Atro-vialacea, Picholine. For table: Regalis, Uvaria, Manzanillo.

Olives imported from Florence, Italy, are: For oil: Razza, Grossajo, Morinello, Belmonte, Rosselina, Leccino. For table: Olivastra, Santa Catarina, St. Agostino, Ascolana No. 1 and No. 2.

Those mentioned last are the famous white olives of Ascoli, described and illustrated on page 88 of the annual report of the State Board of Horticulture for 1889. These olives are said to cost, in London and Paris, 20 cents apiece.

It is my intention to import three varieties more from the eastern shore of the Mediterranean. One of these is grown on the Island of Mytalena and two in Syria. The special interest which these olives excite in my mind is their freedom from bitterness, no process being required to discharge this principle from the pulp.

Those who have attempted to cure the Mission olive for the table, can readily understand the great advantage of working with an olive where there is no danger of injuring the pulp by the use of lye or lime.

If necessary, I will make one more journey to the Mediterranean and bring these olives to California; have them multiplied in the greenhouse, and put within the reach of the cultivators in our olive belt, where I am sure they will be appreciated. And now, before closing, permit me to give you a few items suggesting impressions while traveling through this olive belt of southern Europe.

First—The trees were as different in appearance as the apple, the willow, the well grown Bartlett pear, and the magnificent live oak, which has been growing on a rich soil for a thousand years. Some varieties growing on the shore down to the water's edge, if transferred to the interior, would languish and die. Some varieties doing well in the interior, would not give satisfactory results on the shore. The trees, whether along the shore, on the plains or hillsides, were growing on red soil. The only exception to this which I noticed, was the district near Naples, where volcanic upheavals had given the surface soil a dark purple color. The trees growing there, on the plains near Naples in that dark colored soil, were of great size, and noted for their fruitfulness.

In some places, passing along the edge of an interior valley, where the steep hillsides were terraced and planted with olives, and all work of cultivation must be done by hand, the view was discouraging. The stunted trees were standing in soil baked by the summer sun, as hard as an adobe. The stems of the trees were from ten to twelve feet high,

with a top as flat as a table, having been cut back to increase fruitfulness. On the other side of the train lay a plantation on level ground, extending from one to five miles in width, with trees having the appearance and shape of the grand old oaks in Windsor Park, with a soil as red as that which the traveler sees in passing over the Gloriatta Mountains in New Mexico, on the Santa Fe route. The contrast to the eye was very striking, between the results of intelligent, well directed efforts in promoting growth of wood and fruitfulness on the plain, and planting on the very steep hillside, where the trees were left during the long, dry summer without cultivation of any kind.

Second—The fruit of the olive tree differs in color, size, shape, and in its qualities, each great oil district, like Marseilles, Toulon, Nice, Grasse, Aix, and Lucca, producing an oil with marks peculiar to its own location. This oil being made in the cells of the pulp by the hand of Nature, must be expressed and clarified, and then it is ready for use. Differing in color, flavor, and purity, it is esteemed according to its intrinsic value. Some varieties give a small quantity of the finest quality of oil. Other berries are large and pulpy, having little oil, and on account of size are prepared for the table. Again, the fruit differs with regard to bitterness. This principle of bitterness is more or less perceptible in all the varieties, except the green olive of Syria, which carries only a small per cent, considered essential in table fruit, hence in different districts different methods of curing prevail. In one place immersion in strong brine will answer, in another lime is used, in another lye or caustic soda is used to discharge this principle of bitterness. The people of southern Europe use the ripe olives with the bitterness discharged. Go to the corner grocery and watch the laboring man coming to get his supply of olives for his supper. On receiving the order the grocer takes a long handled dipper and passing it down into a large earthen jar, holding a half barrel, brings up the required amount and pours them into the laborer's pail. In the jar the ripe olives with the bitterness discharged are in a brine just strong enough to make them palatable, the air being excluded by olive oil a foot in depth above the brine.

In conclusion, let me remind you of an historical fact, to bring clearly into relief the statement in the first olive bulletin, with regard to the importance of this fruit tree in California. When the Franciscan friars, one hundred years ago, came to found their missionary colonies, among the essentials of comfort which they brought were the Mission olive, and the Mission vine. At this day we recognize their wisdom in the selection. In this respect they did their best. And the good work begun by these wise men has been carried on by the fruit growers of California, and we trust the work will be carried on in the future, until every location where this noble tree can be cultivated with profit shall have an abundance of the finest press olives in the world, as well as a variety of the best for table use, thereby saving to our own people a large amount expended annually abroad for oil and bottled fruit. And I hope, at some future meeting of the fruit growers of California, to place before you samples of these table olives, prepared by my own hand, including the green olives of Syria and the delicious white olives of Ascoli. My observations of the olive belt were confined exclusively to southern France and Italy. I did not go to Spain or Portugal.

VOTE OF THANKS.

DR. CONGER: I move that a vote of thanks be tendered to Mr. Loop. Motion carried.

CITRUS FRUITS AND THEIR CULTURE.

Essay by THOMAS A. GAREY, Garey.

In response to the request of the State Board of Horticulture to write an essay on "Citrus Fruits and their Culture," to be presented at this Convention, I herewith present a few concise thoughts upon this most important subject.

Among citrus fruits the orange is of first importance, with the lemon a close competitor. It is now ten years since I wrote and published my work on "Orange Culture in California." In the introductory remarks in that work the first paragraph reads: "That the culture of the citrus family of fruits is destined to become one of the leading industries of the great State of California is no longer disputed by the intelligent, reflective, and progressive mind. That it is now and will continue to be the principal incentive to immigration into this State is an acknowledged fact." How prophetic my language was is now apparent. What has made Riverside what it is? What is making Pomona and other localities in California noted? *Orange culture.* What has been the greatest inducement to immigration? *Orange culture,* with climate as an adjunct. Witness the thousands of cars, whole trains of our golden fruit, now dispatched annually to eastern markets. "California oranges" are now a familiar article of commerce in all the great centers of civilization east of the Rockies. It is the greatest advertising medium we possess. Deprive "California on Wheels" of its citrus display and you take from it its chief attraction. An individual as an audience never tires of listening to the history of our peerless groves of golden apples, the handsome, symmetrical, and electrifying golden glory of the Pacific Coast.

The principles underlying successful citrus culture are: First, selection of a site for the orchard. Location is of primary importance, while the quality of the soil must be adapted to the successful propagation of the orange and lemon. Location must always be considered first.

The table or mesa lands near the mountains have been proven to be the best localities adapted for the finest and best flavored fruit. In my work on "Orange Culture," page 19, I wrote: "I predict that the future orange orchards, famed for the beauty and quality of their fruit, will be found on our high, dry mesa lands, and that the product of the orchards of the valleys and low lands will find a second place in the orange markets of the world; hence, take warning, and start right by making a careful selection of a site on which to plant your orange grove." The advice contained in the above paragraph is as useful to-day as it was when written.

Second, selection and purchase of trees. This is a prime factor in the future success of the venture. Do do not invest in cheap trees; plant a less number of trees if your bank account is limited. Trees for an orchard should have straight trunks, and evenly balanced heads as tops, and be of good, strong, vigorous growth.

Third, transplanting to orchard. Transplanting to the orchard is generally considered simple and easy, and, with few exceptions, it is done in too much of a hurry. The question is not, how shall I proceed to plant my trees in the best manner to insure a quick and permanent growth; but how can I plant my trees in the least possible time, and with the least expense? All possible dexterity consistent with the success of the venture is commendable and desirable, but when a proper degree of care is sacrified to great haste and careless planting in order "to finish the job," it is reprehensible in the extreme.

It is of primary importance to know in what month to transplant the trees. I have found that May is the best. The ground is then warm, and the weather is mild, being neither too hot nor too cold. There is usually more cloudy weather in this month in Southern California than in any other, not excepting even the rainy season. February is my next choice. June is better than March, and July is better than December or January. I would rather plant in August than in October or November. Plant in May in the southern part of the State, and in February in the northern part, and you may reasonably hopê to succeed.

Fourth, cultivation. Cultivation must be thorough and persistent. No weed should be allowed to grow; the orchard cannot be kept too clean. There is a diversity of opinion as to the depth to which an orchard should be plowed; some favor shallow plowing, some deep plowing. I approve of and advise plowing not to exceed two or three inches in depth, adjoining the trunk of the tree, and within a radius of four feet from it, increasing the depth gradually from this point to the center of the spaces, the greatest depth not to exceed six inches.

Fifth, irrigation. Time has proven that successful orange culture cannot be attained without ample irrigation. Some may claim that (orange) orchards can be successfully grown without irrigation, but I am decidedly of the opinion that he who undertakes to plant and raise an orange orchard without water, on our dry and best fruit lands, will ultimately fail. I am inclined to believe that lemon culture on our deep alluvial loams, where the capillary attraction is perfect, can be made a success without irrigation. I am now preparing to plant ten acres in Eureka lemon trees, on mesa lands in Santa Barbara County, where no water for irrigation is obtainable, and feel confident of success.

Thorough and systematic pulverizing of the soil will, of course, assist in bringing up and retaining moisture, and it will lessen the amount of irrigation required on any lands, to a considerable degree. I take the position that when a practical and economical system of irrigation shall have been adopted, and the water now developed and what can be developed, shall be put into practical use, we shall have an ample supply to enable us to cultivate orchards on all the arable land adapted to this branch of horticulture in this district.

Sixth, fertilizing. The arable lands of California are generally exceedingly fertile. Fields have been cultivated to ordinary annual crops in various localities for generations without receiving any kind of fertilization, and they yet produce crops equal to those of former years. Two crops are taken off annually in many instances, and with no apparent diminution in yield. Thousands of acres have been cultivated to the cereals for a consecutive period of twenty-five years and longer in large portions of our State, producing abundant crops annually, when the rainfall was ample. Perhaps no country responds more promptly and

faithfully to the demands of the husbandman, without fertilization, than the arable lands of California. Large orchards are producing abundantly without having received any artificial fertilizers. This has led many to think fertilizing a useless expenditure; it is, however, thought by many progressive horticulturists that our orchards will grow more thrifty, produce more abundantly, and a finer quality of fruit, with a liberal supply of well decomposed manure. I doubt not that this is true in principle, and that a judicious supply of manure applied annually to our orange orchards will certainly stimulate the tree to a vigorous and healthy growth, and produce an increase in size and productiveness, and a better quality of fruit.

Seventh, pruning. There is much diversity of opinion on this important branch of the science of horticulture. Various methods are pursued; from that of allowing the tree to branch at the ground, to that of commencing to form the top at an unreasonable height; from that of severely letting them alone, allowing Nature full and unrestrained sway, to that of a continuous cutting and hacking. There are involved in pruning several principles, among which are the following:

First—The removal of the branches from the trunk of the tree, to admit of cultivation close to the tree with a horse and cultivator.

Second—The removal of part or all of the limbs that cross or rub one another and that grow too close together, diverging from one point.

Third—Thinning out the center of the top of the tree, cutting out all non-producing branches, to admit of an ample supply of air and light.

A wide diversity of opinion exists on the first proposition. There are strenuous and enthusiastic advocates of low pruning, allowing the branches to grow within two or three feet of the ground. The usual arguments in favor of this method are that it shades the trunk of the tree from the direct rays of the sun, and that it also shades the ground, thereby preventing evaporation, as it is claimed, to a great degree; hence, a moist condition of the soil.

The advocates of what is termed "high pruning" are no less enthusiastic in defense of their theory. They argue that it admits of better and more thorough cultivation, even close to the tree, and at less expense than if the top be allowed to form near the ground. They say the entire surface of the ground, and especially the soil near the trunk of the tree, should be well cultivated, not only for the purpose of destroying weeds, but to pulverize the soil for the retention of moisture, and that the direct rays of the sun should, as far as possible, fall upon the whole area of the orchard.

One most experienced orange grower thinks the soil needs the warmth of the sun as well as cultivation, that the trees may receive the full benefit of the moisture in the ground and that the fruit may be fully developed.

Much more could be said upon this branch of the subject, but I leave it with the intelligent fruit growers to pursue the plan best adapted to the several localities adapted to citrus culture.

On a basis of an orchard of ten acres I would plant six hundred Washington Navel, three hundred Mediterranean Sweet, one hundred Malta Blood, one hundred Paper-rind St. Michael.

The subject of markets and overproduction I will not discuss in detail in this paper.

In conclusion, may I not consistently inquire if the present mania,

unprecedented in its intensity, to plant orange orchards, is not in danger of, in a few years, glutting the market with even so luscious a fruit as the orange? Would it not be well to plant a portion of our orchards to the olive and fig, both of which, in my opinion, are destined to soon become leading and profitable industries of our favored land?

The Bartlett pear, best canning varieties of peaches, apricots, and prunes, are now, and no doubt will long continue to be, profitable to produce.

LEMON CULTURE.

Essay by HARVEY C. STILES, National City.

We, as fruit growers, all know, or have it yet to learn, that to produce an article of merit is one thing, to furnish it to the consumer at a price which will give a fair remuneration for our labor, is another; and perhaps the latter consideration is the more important, at least it is the more disagreeable one to have staring us in the face. Yet it must be decided. It is the old contest between the ideal and the real. The orchardist's life is the ideal one, from the time he selects his location and plants and watches his trees, till his fruit is boxed for market.

Then he is a tradesman, and has need for a different set of faculties from those which have enabled him to choose the proper soil, location, and climate for his specialty; to determine what varieties, what stock, what methods of planting he shall adopt; what are the complicated influences of pruning, training, fertilizing, irrigating, picking, curing, packing, and the thousand and one other points which go to decide whether his product shall be denominated a triumph of his art or only mediocrity.

There is certainly quite enough in this category of puzzles to satisfy the true orchardist, to which each separate item is a study of absorbing interest, without his entering thus into the radically different world of commerce. And yet the question of disposing of the product must be met. In countries where the product is dictated, so to speak, by peculiarities or rigor of climate, we must meet it as best we can. But here, in this land whose planting time is always, we are masters of the situation, if we look before we leap.

We may choose from the products of the world for our specialty. Let us then choose that one in the marketing of which we shall have the least competition; that product to which the least area of the world is adapted, which is in universal demand, and to which our country is most perfectly adapted. That product, I believe, at least in my locality, is the lemon. Even in countries where the lemon does not do so well as some other products, and not nearly so well as here, it is considered one of the most profitable crops that may be grown. How appropriate then to plant it where it grows better than anything else, and where the product is unsurpassed.

The area adapted to its perfect production is extremely limited, as we shall see by referring to a map of the world; and we shall discover, also, a very curious and suggestive fact, viz.: all those lands and countries well adapted to the production of the lemon are noted as the sanitariums of the world. To them man journeys, and says: "Here is the perfect climate; here let me live and die."

Is it not so? Lisbon, Italy, southern France, Sicily, California—lands of the lemon, lands of history, lands of poetry and song and romance. It is appropriate that in these countries, where flock the sick, the infirm, the invalids of the world, for comfort and healing, should be grown this fruit, which has such valuable medicinal qualities.

A Florida wag has said that good oranges grow only where there are mosquitoes, yellow fever, and alligators. Now, we don't believe this; but there is a grain of truth in it—just enough to spice the assertion sometimes made that "San Diego oranges are not nearly as good as the Florida product." San Diego possibly (probably) lacks some of the aforesaid qualifications of a good orange country.

We have a lemon craze in Southern California. The sooner the area so well adapted to the lemon is planted out the better. Let us plant lemons, but let us not plant them in situations not so well adapted to them as to some other products, or where they will grow only at a disadvantage. Let us not plant them in hot, back valleys, for they are nearly always correspondingly cold in winter, and the lemon is extremely sensitive to frost; while the orange, if not too cold, will probably do even better there than it will nearer the coast. And let us not plant them in the cold, frosty valleys near the coast, for the same reason. But let us plant them in our warm, dry mesas and sunny slopes, and in the valleys where there is no frost in winter, nor extreme heat in summer; where the atmosphere is ever kept so moist and mild that the sweet, pink-tinted blossoms can expand and perfect fruit every day in the year. My choice of a location would be a high, well drained mesa, with a southern exposure, and a rich, red soil with a depth of six to fifteen feet. I should also like it to be several miles from the sea, for several reasons, one of which is the greater ease with which the trees could be kept free from scale insects. However, I do not consider this a deciding point, as the destruction of the black scale, even close to the ocean, is only a matter of a few cents each year. Some of the finest lemons I have ever seen were grown in Hon. F. A. Kimball's grove only a few rods from the salt water. They were also on adobe soil. I do not consider the adobe soils objectionable, providing it is well drained, either naturally or artificially, although it is of course more disagreeable to move around upon as much as we must necessarily do in gathering the constantly ripening crop.

So we see that, after all, the three principal requisites are: freedom from frosts, a sufficiently mild and humid atmosphere, and plenty of water. I believe a bearing lemon tree, in this favorable location, will use five times as much water as an orange tree of the same size, for the simple reason that it will produce five times the amount of fruit during the year.

As to fertilizers, it is only a question of time when all soils will require them, and the sooner their use is begun, the less will be the deficiency to supply. The adobe soil will be last to require fertilizing, as it is strongest in plant food; but even it must soon become impoverished by the tremendous drain the bearing trees are constantly making. I know of plenty of ten-year old trees, which produced last year thirty boxes each, or about nine thousand lemons. We cannot expect any soil to give us such crops every year without some return. I wish every one starting a citrus grove could be impressed with the importance of having the trees headed low. This is especially true of the lemon; one of the most

obvious reasons being economy in the repeated pickings. Besides, experience and observation have demonstrated that the greater proportion of fruit for many years will be gathered very near the ground. I do not know if this latter fact is due to the shade, which is thus procured or not; but it is certainly true, and I believe teaches the importance of a judicious shortening in, to produce a closer head than the lemon naturally produces. The value of these low hanging branches, to protect the trunk of the tree from the fierce heat of the sun, is also evident. If large two or three-year old trees are to be planted, they should be cut back close to the ground, and as they grow up the shoot selected for the tree should be trained to the natural pyramidal form, with a main upright stem, from which the branches are sent out as nearly as possible at right angles. All "forks," or branches, starting at a sharp angle to the trunk should be removed during the first year, else the tree can never bear, without splitting, the immense loads of fruit we expect from it.

For the same reason, the branches should be judiciously shortened in each year, at first, to make them strong and stocky. The comparatively few trees which have been trained to grow in this manner are shining contrasts to the stunted, sun-scalded, high-topped trees whose branches, when loaded, must necessarily come down to the ground, and, as they are not strong, as Nature intended them to be, they split down, and by the wound thus made in the trunk the health of the tree is impaired.

One-year old buds are generally preferable in starting a grove, as they are, or should be, less injured by loss of roots in transplanting, and by the subsequent necessary cutting back. Still, the earliest returns may be procured by planting two or three-year old budded trees.

There are many decided advantages, beside the important one of economy, in planting good, strong orange roots right in orchard, and budding them as they stand. I omitted to state that almost invariably on a light, deep, sandy soil, the lemon is not a success. The trees make too long and slender a growth, and do not bear well, while the fruit is large and coarse. This is also the case where the climate is too hot.

When we consider the prices commanded by imported lemons now, and the immense quantities of them imported, our prospects are certainly bright. And when we can furnish the three million boxes imported annually, of sweet rind-cured California lemons, we shall certainly receive a much higher price for them than we do now for our uncured, common, mixed, and seedling product.

THE LEMON AND ITS TREATMENT.

Essay by N. W. BLANCHARD, Santa Paula.

The State Board of Horticulture have invited, to be read before this Convention, an essay on "Lemon Culture," also an essay on "Curing the Lemon." My topic being "The Lemon and its Treatment," I know what to say without traversing the fields embraced in the first two named topics. Perhaps, therefore, if I give an account of my orchard, my method of picking lemons, with some experiments that I have made in curing, I shall be acquitted of my duty.

My orchard is in Santa Paula, about twelve miles from the ocean, in the valley of the Santa Clara of the south, and has about the same

climate as Los Angeles City. The soil is a sedimentary clayey loam, very deep and very rich. The lemons are upon orange roots, and my bearing trees were budded twelve years ago into six-year old stocks. They have been allowed to grow without pruning, except to cut out the suckers from the inside of the trees. The limbs touch the ground, and in some instances lie upon it and cover half the space between the trees, these being twenty-five feet apart in triangular form. On the theory that lemon trees need less water than orange trees, I tried the orchard with less frequent irrigations, but now irrigate as often as I do the orange trees, finding it best to do so.

The lemons are stem cut, and are gathered by taking all, without regard to color, that will pass through a two and one quarter inch ring. During the more active ripening season the lemons are gathered as often as once a month; for instance, the orchard was picked early in January, again early in February, and again early this month, and the picking is not yet finished; indeed, there is scarcely any month that I do not have lemons to gather. I thus avoid having any very large lemons, unless they are overlooked. The lemons are handled carefully, hauled at once from the orchard, washed from a tub of water with a brush, for we have some smut, placed one layer deep in trays, two by three feet and three inches deep. These trays are slid into a rack for the lemons to dry and wilt a day or two or three in the shade. They are then piled in the curing house, one across another, up to the ceiling.

The curing house is a two-story building, on the north side of and under tall blue gum trees. The lower story is made double walled, the walls a foot apart, filled between with sawdust, with an inner and outer door. From this lower story a ventilating flue sixteen inches square runs through the ceiling and upper story and roof. The lower story is divided into compartments, the object being to keep the rooms cool and dark, and to avoid a circulation of air. The more the doors are open, or the more air circulating around the lemons, the more rapidly the curing goes on. I can prepare my lemons for the market in two or three weeks, or keep them several months. I do not know how long they may be kept without becoming too soft, for I have not yet had time to sufficiently experiment.

I have over nine hundred bearing trees, from which I sold last year two thousand five hundred and forty boxes of lemons, and at the same time the crop was considerably injured, for the first time, by the severe local frost of January 17 and 18, 1889.

In the autumn and early winter of 1888, I had filled one room of the curing house with some six hundred to eight hundred boxes of lemons, the trays being piled one above another so closely as to almost or entirely exclude air from the fruit. I had looked at them several times, and thought they were doing well, and left them perhaps two months in the spring without opening the doors, and when I did so I found the air almost hot, and of course suffered a large loss. I would say that at that time they had a smaller ventilator than the room now has.

On November 9, 1888, I put two very green lemons, just off the tree, into a gallon glass fruit jar—lemons as large as would go into the jar—and screwed down the cover with a rubber packing, and put the jar into a cool, dark closet. They were left there till March fifteenth following, over four months, when I found a few light spots appearing on the

lemons. They were then left until April nineteenth, when I found the inside of the jar covered with moisture, and the lemons half colored up.

The jar was opened and a strong smell of vinegar escaped, and the outer part of the rind of the lemons was so soft that it would rub off with the touch, yet there was no rottenness, and the specimens afterwards dried up. I think the main point in order to keep the lemon some months, is to take it from the tree before it has become in any manner soft, while it is still very firm, and it does not matter if it is quite green, for if it is given time enough in the curing it will change to a fine lemon color.

I believe the character of the soil is also a determining factor in the keeping quality of the lemon. It is asserted that the citrus fruits in the countries bordering the Mediterranean Sea, grown on clayey soil, will keep better than those grown on lighter or sandy soil. My experience and observation prove this to be true in regard to the orange, and I think it must be true also in regard to the lemon.

I will add that lemons two and one half inches in diameter, when cured, will go about two hundred and fifty to the box; two and one quarter-inch lemons, about three hundred to the box; and two-inch lemons, three hundred and sixty to the box.

Mr. Blanchard added: Mr. President, while I have the floor I would like to state one peculiarity I have noticed in my orchard, and which, if any one can give an explanation of, I would be glad. I have noticed that in budding my trees to lemons, that when the bud would shoot off and make a tall growth, growing right up into the air, it immediately commenced to fruit. In other instances, where it made a short growth, with many branches and a thick growth on the tree, it would take four times as long to come into fruit.

The President: Now, as the subject of lemon culture, as well as the other essays are before the Convention, and as the request has been made to me that Dr. O. H. Conger, of Pasadena, be allowed twenty minutes, or such time as will be necessary for him to explain his theory with regard to growing the lemon from the cutting, there being no objection, I would call upon Dr. Conger to make that explanation. Let it enter into the discussion of the subject of lemon culture. [Applause.]

Dr. Conger: Mr. President, and Ladies and Gentlemen: The time having been allotted to me on this subject of "Lemon Culture from the Cutting," I will commence by calling your attention to the excitement that prevailed here in Southern California about ten years ago on the China lemon stock as the proper stock to bud the orange on. Mr. Thomas and Mr. Baldridge particularly, will remember my attitude at that time, simply from the fact that I combatted the theory. I hadn't at that time had any experience. The China lemon roots were budded to the orange and sold very extensively over this country. I protested. I said it was unreasonable to expect the two extremes of sugar, or sweet and sour, to meet in that form of budding one to the other, and have as a product a definite result of the one only. To illustrate, I asked the question: "If an ounce of sugar, dissolved in water, and the equivalent of citric acid, and which we know is the product of the lemon, dissolved and added to that solution of sugar, would produce a definite and distinct acid property to the taste?" We all know that it would not. I said: "Can you bud the orange to the lemon and say that Nature shall absorb one func-

tion, that the root shall entirely control the bud, or that the bud shall entirely control the root, when the sap from the root is to ascend that tree, and be elaborated in the leaves of that tree, and return not only to produce wood structure but to produce the fruit?" To me it seemed unreasonable. I combatted it on that theory. If you will go up Spring Street, a little way above First Street, you will observe there exposed for sale, monstrous great oranges, nearly six inches in diameter, carrying all the characteristics of the Washington Navel orange. There you will see the product of this budding the Washington Navel orange on the China lemon root. It is absolutely worthless in a commercial sense. It is only as a curiosity that it is exposed for sale. No longer does any person in Southern California grow the Washington Navel orange upon the China lemon root for the market.

Now, Mr. President, and gentleman, I called your attention to that fact for the purpose of putting every one upon his guard in thinking that the lemon budded to the orange root will produce as strong a solution of acid property as they will upon their own stock. I say I send out this word of warning.

A gentleman came up from Long Beach the other day, looked my lemon trees over that I put out fifteen years ago from cuttings—in fact, raised from cuttings that I obtained from Mr. Richardson, of San Gabriel. These cuttings were cuttings from cuttings. They were at that time, I think, about five years old. I said to Mr. Gillett, of Long Beach, "Come up and see my orchard before giving your order for cuttings." He came up last week. He ordered his two thousand five hundred cuttings, after looking over my first settings and those of later date.

Now, the point I wish to make is this: that you are absolutely running a risk in regard to the quality of the lemon by budding a lemon to the orange. When, in the market, they call your attention to the imported lemon, we understand to-day that they are raised principally upon orange stocks. What I pretend to say is that there is soil by acres, by hundreds and thousands of acres, in Southern California at least, where the cutting will do as well for a root as the orange stock. I claim, therefore, that that is the natural soil for the lemon. I do not pretend to stand before this intelligent audience and claim that the orange root does not produce a nice lemon for market. I claim simply that the lemon from its own stock, not the seed, but a bud which you can obtain by the cutting, and in no other way, is a better lemon.

I obtained those cuttings without any knowledge, upon hearing Mr. Richardson's statement and seeing his orchard, of what they would do. I hadn't any experience; I hadn't read anything in regard to citrus culture. My life has been spent in other pursuits. I innocently took these cuttings, and put them out to grow my trees, as I would plant a rose from cuttings. I have obtained that result without foreknowledge, without any data. I am speaking of that result. I havn't a theory. I bring this before this Convention for you to consider. But, at the same time, consider the location, the soil. I would not guarantee a cutting in adobe soil or in a heavy clay soil. I have not had that experience; I would not put a lemon on an orange stock in that soil with what experience I have had, if I could obtain the better soil for it. It is on that theory, Mr. President, that I say this precaution should be taken, that in the future we will send to the market the best products that is known to the world. That is my point. Because our lemons are, in fact, superior

to all the tests that have been made of the imported lemon already. But I say as our lemons are a better quality in all respects, especially the Eureka lemon, than anything that is imported to this country, I have a direct interest in seeing that this State shall send the best lemon back to Sicily that the world knows of at the present time, instead of importing the five millions annually that we now do from that region. I stand before this audience to declare the fact that there is danger, having this experience with the China lemon, in any soil, that after the tree reaches a certain age it may take on one form or the other. The saccharine property, taken naturally from the root, may assume control and reduce the acid quality that we are seeking. I can't understand that one function is annihilated for the benefit of the other. It is utterly impossible in considering plant life. The late Mr. Marshall Wilder was authority, I believe, on deciduous fruits. Mr. Downing is another authority. In the writings of both we will find where the apple and other fruits have been amalgamated with other properties. So it is not confined to citrus fruits. In planting I first dug a trench two feet deep on either side of those cuttings, and filled them with water, having pulled out the roots to their full length. I dug holes in the orchard as deep as I thought proper, and drove an iron bar down as far as I could at the bottom of them, and put those radicles down that hole. In sandy loams you do not have to put on the same quantity of water to accomplish the same purpose as in adobe soil, if you have fertilizers sufficient to supply the demand of the tree. I had that experience in this way: My orange orchard was upon high mesa ground on Orange Grove Avenue, Pasadena, and in one corner there was a section of adobe soil, or cement, of an iron character—iron and lime, possibly; at all events it was cement. It was so hard that you could not pick it when it was dry. There were eleven orange trees that I had covered that ground with, not knowing from the surface indications what the subsoil was. That was my first experience. I found they didn't do as well as those twenty or twenty-five feet away. I looked at them. They had a little round cabbage head, as I called them; small leaf, stunted, while the others sent out great long shoots and vigorous leaves. My curiosity led me to dig around them, and I found the roots to correspond with the top—a mass of hair roots, little fine roots, within five or six inches of the surface of the ground. The radicle had rotted away. I dug into the soil, and found, a foot below the surface, this cement, and that, to my mind, was the reason of finding those trees in that condition. I dug them out, and went down through the cement about two feet, and came into the sandy soil. I replanted the trees so that the roots could go below, and in the second year they could not be told from the other trees of the orchard.

Now, Mr. President, and gentlemen, if you place your trees within two feet of a subsoil that is impervious to the water from the surface or from below, you have got to feed those trees as you would feed a cow or animal of any kind; water them and feed them regularly. That explains the reason of the necessity of an abundant use of water in a great many places. If you put orange or lemon trees upon soil that has no substratum of impervious soil, you can accumulate winter rains and store them up in the soil, to be returned almost during the entire season, especially before the fruiting stage. I raised those trees to the fruiting stage without one single irrigation. Any gentleman of this audience can go and see them to-day. For eight long years they never had a

particle of artificial irrigation. That soil hasn't any bottom, so far as I know; there is no substratum to cut off the water. But the moment that they began to bear, or the second year, I discovered a deficiency; that is, I thought I discovered the fruit was not developing as it ought to. I then irrigated forty trees, adjacent to forty which I left without irrigation. There was every difference that could be imagined in regard to the size, appearance, and general characteristics of the orange on those trees that were watered twice and those that I did not water. I immediately went into the public press and stated those facts. Now, could I do more or less? I said to the community: "Don't depend upon an orange orchard that you haven't water with, because when they come to the age of fruiting there is another function developed." They hold there in suspense tons of water when you have a large crop upon your trees that is neither given off to the atmosphere to be absorbed nor for any other purpose; hence, you have got to supply that demand, and it can't be supplied except by putting it onto the roots. That is common sense. I went, therefore, just as far as my judgment—just as far as the indications of the tree warranted. I withheld the water, because they made all the growth that was necessary, and many of them more than it would seem possible under that rigid exclusion. Those are facts that men came from all over the State—Mr. Wetmore, from San Francisco, and others—to see. I claim nothing for that. I never set a tree in my life before fourteen years ago. I knew nothing whatever about this; I came upon it through accident, feeling my way along. Happening to get the right kind of soil for this experiment at the start, which I was not at all aware of, I have made those experiments simply by watching and waiting, and trusting to the future developments as they would come along naturally in their order.

Now, if there is any lesson to be drawn from this, it is that you can make a perfect lemon tree grow from a cutting in the proper soil. You can grow a lemon tree on an orange in any condition of soil. My point is that you cannot make as perfect a lemon on an orange root as you can on its own root and own stock, and it is nonsense to say that you can't get radicle roots from a cutting in the proper place.

I could talk some longer in detail, but the substance of what I have said I trust will be sufficient to cause every person who contemplates putting out lemon trees to look well to his soil, as Mr. Garey and others say who have had experience, at the start. Then, the water question. The lemon grown upon its own root or stock does not require the water in its natural habitat as it does on the orange stock; and when those essays speak of irrigating the lemon, Mr. Blanchard's for instance, it is on an orange root, is it not? It has got to be supplied the same as an orange tree, because it is on an orange root. It is not because it is budded to the lemon. It is simply because it is on the orange root. There are thousands of acres of land throughout Southern California that would produce crops of lemons without a drop of water. Mr. Bonine, a neighbor of mine, is putting out ten acres to-day, from the result of experiments. He has not a drop of water except what is pumped from a well eighty feet deep. What I mean to convey is to put your stocks to fruit where they naturally belong. As Rev. Mr. Loop has said, in the three or four hundred varieties of olives they put them in the soils best adapted for the particular variety. We know there are endless varieties of soil. We should use our judgment and take advantage of those bet-

ter conditions, that we may in the future hand down to posterity an absolutely improved result, something that will be lasting.

Mr. Thomas: I would like to ask my friend Dr. Conger if he knows how many trees he planted ten years ago, and I would ask him how many of those trees are alive, and also with reference to any other trees grown on lemon cuttings that have not died? Some nineteen years ago I planted a lemon orchard in the City of Los Angeles on some stock that was raised from cuttings. After awhile the roots became rotten and decayed, and the trees commenced dying. I put ashes around them. That arrested the progress of the disease somewhat, but most all the trees died. That has been the experience of all those who have planted (that I know anything about) lemon trees on their own roots. And for that reason I have always advised people not to plant any lemon trees except on the orange roots.

Dr. Conger: My answer to that is this: In the first instance I never lost a tree—not one. There never has been a gum disease on my place, except where my reservoir gave way the third or fourth year, after I put out my orange orchard, by a gopher working; it flooded quite an area of my orange trees. Four trees were attacked with a gum disease which I attributed to that flooding. Not one lemon tree from my cuttings ever showed gum disease. Now, if I should be thrown into the Pacific Ocean by a set of ruffians who wished to play tricks upon me, and would pull me out upon the warm sand and rub me, put blankets over me, bring me to, get me all in good shape, and take me and douse me in again just as I would recover from that shock, and keep it up, how long would I stand it? [Laughter.] Well, that illustrates the whole question. I say where you have to put on water don't put out lemons. Put lemons where you can control them the same as the engineer controls the steam of his locomotive. Any soil that you can feed and water and control the moisture and food in that manner, you can dictate to your lemon product just what you please. I will throw them into bearing in any period I may wish if I am in a soil that I can control in that manner, which I have done. And to-day, if I was to engage in the lemon culture, I would select a deep sandy soil, that is rejected by some one, Mr. Garey, I think, from the fact that I would have it under absolute control. Then I would have them blossom in September—or August rather, which I can do. Then my product would come out in the spring, when I would want it. I would not have to lock up my money five or six months, which I am doing to-day, to carry my lemons, in order to have them ready for the proper market.

Mr. Johnson, of Montecito, says that seedling lemon trees are never attacked with gophers, whereas his orange trees are constantly attacked with them, and he has to fight them all the time.

Mr. Kinney says that his lemon trees are attacked on lemon roots and lime roots both the same.

Mr. Wheeler: I would like to ask three questions about lemons. First, I would like to state to the orange growers here something I heard yesterday with reference to the soil most adapted to oranges. A gentleman from Riverside—I presume he has said the same thing to others—Mr. L. M. Holt, told me that in a few weeks he had had his judgment of fourteen or fifteen years reversed. He had always until then been of the opinion that the soil best adapted to the orange culture, both as to the growth and quality of fruit, was a fine, sandy loam, with a gravelly sub-

soil. But he said that at the last fair at Riverside, nearly all the premiums were given to fruit grown on the clayey soils—the clayey soil commencing, I think, at Arlington, with some few exceptions of sandy streaks, and gradually growing more sandy into the town. He said these premiums were given, almost without exception, for quality of fruit grown on clayey soils.

Now, my experience in Pomona, where I have been farming on a small scale for six years, is this: My orange orchard was set out four years ago. It is on a sandy loam, in some places a very gravelly soil, occasionally a fine sandy loam, with a gravelly subsoil. I know that my fruit is as good in quality as any at Riverside. Last year I did not irrigate but twice, the first time in the middle of July; and the soil is, as you all know, much more easily cultivated than clayey soil.

The three questions I would like to ask about lemons are these: First, as to the soil most suitable. We heard to-day, from a gentleman from Santa Paula, that he preferred a heavy, sedimentary soil. I heard at the last County Pomological meeting, at Pasadena, from a man who gave a talk on lemon culture, concisely, that he would prefer a soil which would cost him $60 an acre to clear from rocks, to a heavier soil.

The second question is as to the curing of lemons. During the last few months I have read various apparently directly opposing methods of curing them; several substantially like that pursued by the gentleman from Santa Paula. There has also been a long article copied from a Florida paper, giving a description of some process there, which, I think, is this: The fruit is picked of the right size, green or not, put into boxes, I should judge from the account equivalent to fill our ordinary orange box, put into an almost air-tight house, heated artificially until it reaches a temperature of about 90 degrees, and there kept for five days. And that article said then the lemons would be perfectly cured, and keep, I think it said, for a year. Those two methods seem to me opposing, and I would like to ask the lemon growers here if they think that method would give that keeping quality to the lemon.

The third question is whether they have noticed any difference in the keeping qualities of the different crops or pickings of lemons. Some one in my town told me that those picked in October and November kept very well; those of successive winter pickings kept less well in proportion.

A MEMBER: I had correspondence with the gentleman who wrote the article in the Florida paper. He says in his article the lemons so prepared will keep a year. Does not say he has kept them a year. He is a physician, living in Campaign, Illinois. He says they won't keep at all in Florida in that way, but in Illinois they will.

MR. PAINE, of Redlands: As a matter of fact, I want to state in connection with growing lemons on lemon roots, that nearly everywhere in San Bernardino County lemons there grown from seed or cuttings—they were planted so long ago I can't tell which—so far as I can observe, are all either dead or dying in every section of the county. It may be owing to the fact that they have been irrigated, as they necessarily are on the mesa. But it is very uninteresting to see that result. And I have observed quite largely in the county generally. I have been there since 1870.

A MEMBER: I would like to ask the gentleman of San Bernardino if there is not a hardpan underneath there not a very great distance down.

MR. PAINE: It varies; but it is uniformly the case in all parts of the county, whether there is hardpan or not, that the lemons are either dead or dying, and for that reason we have found it impracticable. Lemons on orange roots do not die quicker than oranges from other diseases, but uniformly the lemon dies where it is on a lemon root or cutting.

DR. O. P. CHUBB, of Orange: Before the discussion on this point is closed, I want to say that we must not lose sight of a general principle prevailing in all cultivation, and that is that the greatest amount of vitality and vigor must be at the bottom of all our experiments. By reflecting a moment, you will see how we have obtained the great results in all the progress we have made—the cultivation of animals as well as plants from a vigorous stock. And we have adopted it in all of our cultivation and progress with successful results. We have found that the vines, when giving way by phylloxera, have been restored by grafting on the native, vigorous stock. We have found by planting nurseries of orange stock, that the wild, native seed is better than selected seed from Mediterranean Sweet, or any other cultivated variety of orange. We have found also that the finest orange grown in Florida—in fact I may say nearly all the oranges grown in Florida—are grown upon the wildest, most objectionable stock in itself that can be found, the wild, sour orange; and yet the finest flavored orange, to my taste, that I ever partook of, was that from the Indian River country in Florida. Showing to me that it does not necessarily follow that the product of improvement must partake of the character of the stock always.

Now then, the matter of our oranges on China lemons has been referred to. I have had experience in that, and at once came to this conclusion: that the mistake is in grafting a stock of superior vigor upon one of less vigor; the tree thus outgrows the root, and the vigor, which should have gone into the root, goes into the fruit. Besides, the tree soon becomes worthless, from the fact that the root cannot sustain the top. On the other hand, we have grafted the lemon, budded that into the orange stock, and never have found such results. We find that we produced a first class orange from that; and not only that, but one capable of being perpetuated under almost any circumstances where lemons can be grown. No one pretends to deny that a lemon tree grown from a cutting will produce specifically the fruit that the tree produced from which the cutting was taken; but will the vigor of the tree propagated in that manner last so long as it would by being propagated upon more vigorous, and I may say, resistant stock? My opinion is, that all progress in vegetable or fruit growing must recognize that principle as a basis. We must retain the vigor, the resistant property, the life principle, at the root, and then we can go on with our cultivation and improvement to any extent.

MR. ABBOT KINNEY: Mr. Chairman, in antiquity they used to burn heretics. I think if we were living in those antique times we would have to burn Dr. Chubb—a man that comes in here and says the best orange he had ever eaten was an Indian River orange. [Laughter.] I have been to Indian River myself, and the average oranges in Florida, including the Indian River, which are very fine oranges indeed, are sweet; I think probably average sweeter than they do here in this country. In speaking of the flavor or characteristic of fruit from memory, I think one is very liable to err; but from my experience with those oranges, as well as with other oranges in different countries—in the Mediterranean orange

country itself—I should say that we here in California have the very worst orange that can be found in the world to eat, and also the very best orange that can be found in the world to eat. I believe I have eaten the worst orange I have ever tasted in California, and the very best. That is what I think I can say with security. In the fair at New Orleans, in which we competed with the Florida and Louisiana product, I think I am right in saying that we took the prize over them in every respect. We competed with them there on fair ground, and took the prize away from them; and so it seems the fair thing to say that we really do have the best oranges. It is a question that has been raised here by Mr. Garey, who is an old experienced grower, that this soil and situation question is a very important one, and we ought to bear that in mind all the time. You can find very poor and very good oranges in California.

I was shown to-day an orange from Florida which had the purple scale on it. I have never seen it before; I had heard of it. But it is the worst looking, most disfigured fruit from scale I think that I have ever seen. It is a very dark scale, and speckled entirely all over—a very ugly, disagreeable looking scale. I was impressed by seeing it with the extreme danger of introducing this new enemy into this country, and I thought I would like to ask the Quarantine Officer what efforts are being taken to exclude it. If I am correct in judging others by myself, there are a great many trees imported into this country direct from Florida, and also from other countries. At my railroad station I got an invoice of trees myself the other day, and I don't know of any one being there to see what was on them, or what there was of danger amongst those trees. I should be very glad to see quarantine regulations adopted that would protect us from this scale.

If no one else has anything to say about olives, I will make a few remarks more in the nature of questions or suggestions than anything else. I would like to ask any gentleman here whether he knows the kind of olive that is eaten. I don't mean the character or particular variety, but the kind of pickled olive that is eaten in Italy. I don't know but that you know that, Mr. President. I traveled to Calabria when I was a very young man, many years ago, and my recollection is that all through that country they eat nothing but the black olive. I can't remember now ever having seen a green olive similar to those we get here, known as the Italian olive. If you have eaten the two different kinds, you will know they are entirely different in flavor and character. The Queen olive that we get here, the principal green olive, is a large olive, generally in vinegar or something of that sort; whereas, the black olive is pickled in salt, first having gone through a process of lye. As far as the process is concerned in California, that is the way I treat my own olives. And it is entirely a different flavored article. As far as my taste is concerned, and those whom I have heard speak of the matter, they all prefer the black olive. If it is true that that is the olive eaten in Italy, in the home of the olive, or one of the principal homes, that is the fruit we ought to imitate them in curing. The difficulty of obtaining the California olive properly cured is very great. You get them soft sometimes, and sometimes with the bitter still in them; and other times with the bitter out and the oil and flavor out as well. And it seems to be rather a delicate and difficult operation to get the bitter out and leave the flavor and oil in. But when you

do that, when you really get a perfect quality of black olive, or partially green—I don't mean to say they are all necessarily ripe, but as you pick them, partly green and partly ripe—that you get a very fine article of food, indeed. It will form a meal with bread and butter—just the olives and bread and butter—and it leaves a delicious flavor in the mouth for quite a time after you have eaten them. My experience in olive growing, in other respects, is entirely limited to a few experiments in making oil, which was a failure. But I pickle all of my own olives for my table, and we never eat anything else; never think of eating a green (pickled green) olive.

MR. PAINE: The Citrus Fair held in San Bernardino was designed to hold but one week, but on account of the rainy weather was held for two weeks. There were exhibited from a few trees some oranges grown on sour stock. The seed had been planted in this country, the trees grown, and different varieties of our oranges budded upon them. At the close of the fair, when parties exhibiting had taken or were taking their fruit away, it was remarked by some one that the oranges on those plates that were exhibited as grown on sour stock were decaying. The attention of myself and several parties was directed to that, and we found that that was the case; that during that time of two weeks there the oranges grown on sour stock were decaying, while those grown on our stock were sound. I heard it also stated from those who have shipped oranges from Florida that you do not expect oranges grown on sour stock there to keep more than two weeks.

MR. LELONG: This question came up some time ago for discussion in the city, and a good many have asked the question that if the stock is a good stock why not get it because it is so cheap; and that if it is not a good stock that it grows so thrifty and the trees do so well on it that in ten years you can keep on replacing as they do in the orchards in Iowa. They plant the tree, and keep on planting in between, so when the tree dies out there is one near by that produces something. And I think Mr. Kinney, Mr. Baldridge, Dr. Conger, and a great many here well remember when they first began planting oranges budded on the China lemon root. Thousands of cuttings were then planted. We budded them, and in two years we grew a tree that can be grown on no other stock one half its height. A lemon cutting one year old was the size of an orange tree three and four years old. We would bud that in the spring, and when June came we had a bud three to four feet high. We used to sell them as high as a dollar and a half per tree. That was a very quick return. Many preferred that stock, because they said they would fruit so much quicker, observing the rapid growth of the buds. But with the first crop the trees began blowing over, and every tree had to have three or four stakes around it, and baling rope tied from the tree to the stakes to hold them up, the same as when trees are planted on shallow hardpan. That was the result of China lemon stock. Thousands of trees were planted, and just about the second or third year's fruiting the trees would blow over, and had to be taken out and replaced. I don't suppose there are any orchards which were budded in that way in this county now. In those times there was such a demand for trees budded on the China lemon that seedling California Sicily lemons were budded to the orange, and also upon thousands grown from the cutting. Those were also treated in the same way, and the result was the same. I don't know of any orange orchard fruiting to-day budded

upon this root. Where the lemon has been planted on its own roots it has not done well, excepting a few cases where the conditions have been favorable. An orange grown on this China lemon stock generally grows very large, but the fruit itself deteriorates so much that in many instances is rendered worthless. Of course, if you want to buy oranges for size and looks, those are the oranges to buy; but when you come to eat them they are very insipid and acid and have a very thick rind. There is a sport, however, that has been planted throughout this section, believed to be a good variety of lemon to plant as a stock, and is quite hardy, and that is the best lemon stock I know of. Nothing seems to affect it, but the fruit produced from it is far inferior to anything that I know of.

Now, with regard to the Florida stock. Mr. Haywood, of Orange, I think was the first in this State that ever planted orchard trees budded on that stock. To-day it has been reported that that orchard is dying out. I think Dr. Chubb could tell us something about it. Mr. Haywood sent to Florida, got the seed, planted them, and budded the trees with choice varieties. Afterwards a great deal of that stock was imported into California, and in the last three or four years considerable has been imported and planted in orchards. In the northern part of the State I think there are over two hundred thousand trees budded on that stock, and nurserymen claim that it is a much hardier stock. But I find that wherever (you can see it here in the nurseries) the bud is two years old on the Florida stock it is nearly twice as thick as the stock below. It shows the stock is hardy. The grain is much closer, and it does not seem to swell out as much as our sweet stock, and in time you will find that the lower part will be much smaller than the upper, the same as you see some varieties of apricot on peach stock, as much larger on top than below.

I want to tell you about another tree of this species. Years ago, when I was connected with the Wolfskill orchard, in fact when I went there in 1869, there were trees there already budded on that stock, and they may be there yet. They are in that little orchard that Mr. Wolfskill retained for himself. They were large trees, budded by old Mr. Wolfskill. It was of a very hardy kind. The stocks below were much smaller than the bud above, and the trees seemed to have been dwarfed by the operation.

The Japanese, instead of making a tree grow high, dwarf it by budding the sweet orange upon the Citrus trifoliata (a sour species), and the smallest tree they produce brings the biggest price in Japan. Awhile ago I saw where they offered £500 as a premium to whomever would produce a tree twenty-five years hence that could be laid upon the table in a pot, and the tree not to be over twelve inches high. That stock is very hardy, and in this respect is similar to the Florida sour stock. Mr. Weeks, at Alhambra, has a Satsuma orange which is the same as that imported by nurserymen from Japan, and called Oonshu. The trees of this variety budded on the California sweet stock produce fruit three or four times as large. The quality is much better, and the trees are quite a good size. Take a tree three or four years old, on the sweet stock, and it is four or five times larger than any tree that you can see budded on this Trifoliata. The Trifoliata dwarfs it. The sweet stock makes it grow up. That is the difference.

Dr. Clafflin, of Riverside: I suppose the design of this discussion is

to draw out the facts of the case with regard to the sour stock of Florida. And I would like to say that inside of two weeks I stood in and went among the trees within a grove known as the Spear grove, near Sanford, in Florida, the trees covering about five acres of ground and being fifty-four years of age. About one half of those were budded on the sour stock and the other half on the sweet. Of those budded on the sour stock all are living, and are thrifty trees. Of those budded on the sweet stock nearly one half are dead from what is known there as the foot rot.

With regard to the size of the trees below the bud, the sour stock has grown so that the sour part is equal in size to that of the bud. They look the same as our trees do budded on the sweet stock.

With regard to the size of the trees grown on the sour stock, I think as a rule in that grove, and in other groves in Florida, the size of the trees at the same age is a little less on the sour stock than on sweet, but only a little less. It has been a very dry winter there, and during the two months or over I spent there this winter, I had a chance to see the difference between the sour and sweet stock, both in small trees and large, and it seemed to me that the sour stock has withstood the dryness better than the sweet. I have no trees to sell; am not interested in any way in the sale or propagation of the sour stock. I only wish to bring this out so that our people in California may arrive at the facts in the case. I have tried to notice such things and learn all that I could about the sour and sweet stock, as well as other things, while there.

Mr. Lelong: Isn't it a fact that the stock known as the sour stock is not subject to this "foot rot" which they have there, which kills the other stock?

Dr. Clafflin: That is a claim that is made for the sour stock all through that State, that it does resist that condition known as "foot rot." It is a fact in Florida that the sour stock is not subject to foot rot.

Mr. Lelong: In regard to the fruit, did you find any difference in that grown on sour stock and that grown on the sweet stock? Which is the best?

Dr. Clafflin: I had but little chance to know in regard to that, or of the keeping qualities of the fruit. I have eaten the fruit picked from the trees side by side, and could not see any difference in the quality of the fruit grown on sour stock and on sweet stock.

Mr. Lelong: The "foot rot" there looks similar to the disease called here "gum disease," but its effect is said to be somewhat different. This "sour sap disease" that we have in California oozes out from under the bark, and if you once remove that and paint it over or put grafting wax over it, it heals over and checks it. You can entirely cure a tree that way. It has been done. But where the gum disease gets a strong hold on the tree the tree goes. You can't cure it.

Recess until 7:30 o'clock P. M.

EVENING SESSION.

At 7:30 o'clock the President called the Convention to order, and the regular programme for the evening was taken up.

FLORAL CULTURE.

Essay by MRS. JEANNE C. CARR, Pasadena.

Within the past ten years there has been a vast increase in the popular interest in floriculture, arboriculture, and landscape gardening, which is most gratifying in itself, and especially so as indicating the final triumph of man over wild nature, and over his own selfish and destructive instincts, which have hitherto allowed one generation to impoverish many succeeding ones, by the reckless destruction of forests.

It is only in public institutions like our State University, or the Stanford, that floriculture or arboriculture can be thoroughly studied, in representatives of all the great families of trees and plants which adorn this speck of star dust, our earthly home; but, happily, the culture of a few plants in one's window, or upon a city house lot, is an open gate into the treasury of the vegetable kingdom.

The floral adornment of our cities, the transition from a naked, barren plaza to a decorated park, marks an important stage in the development of public taste, and exerts a wholesome influence upon public morals. For every dollar expended in maintaining the public parks of our cities—such inviting pleasure grounds as the Golden Gate Park at San Francisco, for instance—a dollar may be deducted from the expense of policemen and jails.

The decorated, gardenesque park has become the high water mark of public taste and progress in all our large cities—the one luxury which reaches down into the lower levels of the people's life.

The floral embellishment of the grounds surrounding all the great hotels are among the most seductive features of their suburban advertisements; and flowers are the most indispensable and costly features of private hospitality. The forests of the Amazon, the tropic regions bordering the Indian seas, are ransacked to furnish rich men's tables; and this apogee of floral luxury has developed a new school of art and artists. Here, where Nature is so lavish that a barefooted boy may travel upon a floral carpet, which wealth could hardly provide for the satin slipper, there is little danger that floral decoration will run into the extravagance of mere display. No man is too poor in the land of sunshine to wear a rosebud in his buttonhole; the lowliest cot may become a bower of beauty in the rose growth of a single season.

Nevertheless, the floral and arboreal capacities of this favored land are in the infancy of their development, and so varied are the sources from which new materials may be drawn that there is no excuse for any lack of variety. In our public work the winter beauty of deciduous trees has never been sufficiently recognized, or the sanitary importance of having winter sunshine on our sidewalks. As we become familiar with the life of the Japanese, a nation of horticulturists, we find many instructive lessons in the adaptation of horticultural knowledge to the necessities of dense populations. There trees are honored as much for beauty as use, the time of blooming cherry trees being almost a national festival, and every article of household use, and even their apparel, bearing testimony to their love of birds and flowers. Cherry trees adorn the streets of the villages in Switzerland, nor is there loss of crops in consequence.*

*Emulous of these examples, the writer planted and cultivated an avenue of walnut trees upon half a mile of sidewalk—to realize how far we are below the Swiss standard of tree morality.

We have not exhausted the arboreal treasures of Australia and New Holland, while New Guinea is, in part, a terra incognita to the botanist.

A severe check was given to the culture of the acacias of Australia and New Holland by the prevalence of the cottony cushion scale, which, thanks to that blessed bug, Vedalia, is already a matter of tradition. More than sixty species of acacia were planted out on the State University grounds of Berkeley in 1873, and a still larger number of eucalyptus have been grown by Hon. Ellwood Cooper and others during the past year. Eucalyptus ficifolia, the most brilliant of this remarkable family of trees, bloomed for the first time in California in 1879. It was grown from seed by Mr. Charles Schurff, of Pasadena. The trees, not more than six years old from seed, were about twenty feet in height, and well covered with vivid scarlet flowers, in size and shape resembling the blossoms of E. globulus.

Among the shrubs most enjoyed at Carmelita are many old favorites: the Japan quince, Laurestinus, Sweet elder, Lilacs, Syringas, Weigelias, Fabianas, Hakias metrosederos, double-flowering Pomegranates, Nandinas, Daphnes, Pittosporums, and Genistas. The largest trees, now ten years planted, are leriodendrons and tilias, or, "humanly speaking," tulip trees and basswoods. The former were flowering profusely in the spring of 1889. Larches, sequoias, and pines of many species have been grown from seed planted in January, 1880, and, according to their nature, appear to have lost nothing under artificial conditions.

The large family of succulent plants, of which the "houseleeks" are a type, are well represented. First planted in Oakland and Berkeley, the original representative collection of sedums, sempervivums, etc., sent to me by Asa Gray, are now numbered by millions, and have spread from San Francisco Bay to San Diego, the most effective of Nature's carpet plants, and especially valuable in dry climates.

Nor do we love our Shakespeare less among our "carnations and streaked gillyvors," "violets dim," "pale primroses," "bold oxlips," and the "crown imperial," "lilies of all kinds, the flower de luce being one."

A thousand feet of hedge is composed entirely of Ribes speciosum; which, being evergreen, and a profuse bloomer, is one of the loveliest of our cañon plants.

Some good beds of Anemone Japonica, the cactus dahlia, Yucca filamentosa, Agapanthus, are planted in open places; clematis, wisteria, and Cherokee roses, cover buildings not otherwise attractive. Much use is made of Iris pumila as a border plant, and of Iris sambucina to prevent the washing of banks.

Plumbago Larpentæ is cherished for its prolonged bloom, and associated with the yellow corchorus. Such old favorites as the flowering almond, both the rose colored and pure white varieties, naturally group themselves near the spireas and flowering currants.

Among these old favorites, blue and white vincas weave a dense carpet, and are seldom disturbed; receiving a light top dressing of manure before the winter rains.

In the "reserve garden" is kept a plentiful supply of yuccas, grown from seed, and agaves from suckers, there being no limit to their use in decoration. A variety of the more delicate bamboos is highly prized for the same purpose. Of climbing plants we thought Carmelita possessed a fairly representative collection, until a recent visit to the garden of Mrs. Theodosia Shepherd, of Ventura, opened our eyes to new

wonders of the floral world, wonders which must be seen to be appreciated. Cacti, of which a description would read like "Jack and the Bean Stalk," climbing to the eaves of a two-story house; meadows of callas; various novelties too numerous for description, and a boundless supply of old favorites, witness to the energy and skill of one of the most untiring horticulturists of the Pacific Coast.

Southern floriculture is receiving additional encouragement from the establishment of a branch water garden for the cultivation of aquatics in Los Angeles, which is under the personal supervision of Mr. E. D. Sturtevant, of Bordentown, N. J.

What more fitting step could be taken in the onward march from better to best, than sowing the lotus land with this imperial flower? I cannot guess. It was the one missing link in our wonderful chain of symbolic floral gems. Most opportunely, too, when Stanley is enjoying his welcome home, Mr. Sturtevant brings us the blue lily of Zanzibar. Not only these, but water poppies, water hyacinths, the lattice leaves of Madagascar, curious pitcher plants, and the rarest bric-a-brac of the floral world. And while we are wondering over these novelties, we may be sure that new surprises await us. I seem to hear the voice of Nature singing far down the corridors of time:

> "No numbers have counted my tallies,
> No tribes my house can fill;
> I sit by the shining fount of Life,
> And pour the deluge still.
> And ever by delicate powers
> Gathered along the centuries
> From race to race, the rarest flowers
> My wreath shall nothing miss."

A PLEA FOR ANNUALS.

Essay by Mrs. Ellwood Cooper.

This little paper is intended as the first of a series of efforts I propose to make toward writing up the groups of ornamental plants as they arrange themselves in my mind, annuals being first on the list. Although of minor importance to gardeners in general, they have their place in the world of flowers, the loveliness of many of them attracting the notice of every lover of the beautiful.

All acknowledge the pleasing effect of color. The azure canopy above, and the varied hued landscape around us, the violet tints on the mountains in the evening light, and the gorgeous coloring on the clouds around the rising and setting sun; these awaken in the beholder emotions of pleasure and delight. No less pleasing is color around our dwellings. Contrast the impression made on us as we pass, in traveling, a garden without flowers with that which we have when approaching one where we look upon brilliant geraniums and yellow acacias, festoons of passifloras, and wreaths of pink roses.

Then, too, color plays a most important part in the department of use. Nations have it in their ensigns, and traffic needs it for signals. It is stated somewhere that the first step the barbarian makes toward clothing himself is in decorating his body with some bright color. And so important is the capacity to discriminate well between colors that

persons whose business it is often to watch for signals are now obliged to pass examinations, for the purpose of testing their judgment in color. How necessary then it becomes that we do not neglect the development of this important faculty, as it can, like any other, be improved and invigorated by exercise and use. Here comes in my plea for annuals; so many and so varied are the colors and shades which they give that no better school for the eye could be had than a garden where they abound. Why send our youth into studios to be trained in color before giving them the advantage of study in a garden. So easy are annuals of culture, and so soon after the seed is sown do they come into bloom, and so much have florists done in adding shade after shade, that there is no reason why we should not all be surrounded by their beauty.

So much have the assiduous florists done in the development of color, that from one species alone a garden could be made varied and beautiful. Take the zinnia, for example, ranging as it does through shades of red, yellow, purple, orange, and pink. What more is needed to make the surroundings of a cottage brilliant? Almost as much might be done with asters, or stocks, or the phloxes, to say nothing of the glory of the poppies. But there are many kinds to select from, and by varying the time of seed sowing a garden could be kept bright in California the year round. In this management of annuals is a most interesting study, which I recommend to all lovers of floriculture.

Vines and climbers are not wanting among annuals, there being fifteen or more that can be trained on trellises or palings or to the side of the house for scenic effect. First among them are the morning glories, sweet pease, nasturtiums, the ipomœas, Japan hop, cardiospermum, eccremocarpus, and the lately introduced Mina lobata, with its attractive flowers of red and yellow; they are all useful and beautiful.

For greater effect, care should be taken to sow the seeds of plants producing the same color next one another, putting the reds together, the yellows together, and so through all the colors.

We see the proof of this in the blue expanse of the ocean, in the masses of golden sunlight, in the sketches of violet, purple mountains, and in the extended verdure of the landscape. We can imitate Nature, in a small way, by massing the colors in the garden, and at the same time have the benefit of comparing and judging the quality of different shades of the same color. In this practice is the beneficial exercise of the color faculty. Different temperaments are differently affected by color; one person being pleased with one, while another delights in a different hue. There are some writers who assume that temperament manifests itself in choice of color. Here, then, is a study in the philosophy of mind suggested among our flowers.

The seeds of most annuals do better if sown in the fall, the earth seeming to be the natural place for them to strengthen the little germs preparatory to germination, so that when the rains come they spring up, many of them, if the weather is mild, and make well established plants by spring, which will give abundance of bloom well on into the dry season.

If the weeds are kept away and the ground put in order—raked up a little and enriched some before the rains—the seeds being allowed to scatter themselves, there will be nothing to do the following year, or for a succession of years, but to thin out the plants. In this way they do

the best; and this taking care of themselves, doing their own sowing, is another advantage of annuals.

Select the beds for the different colors and sow your seeds respectively, and you will have the work done for years. For those who have not much time to spare from other and sterner duties this is a good way to do. This is the way to get the most for the expenditure of time and means. There is no reason why every garden throughout the State might not be stocked with these lovely annuals. Most of them are hardy and would do well in any part of it. They require little care and repay well the little there is bestowed upon them.

I have neglected to note the fragrance of many annuals. Who does not appreciate the delicious mignonette, and the fragrant atmosphere surrounding sweet pease and the stock jilly, and many others? But I have said enough. Let us all set about to see that our gardens are effective in their beauty, thus testifying that we are a flower-loving people, and that while we study the useful we do not forget the beautiful.

VOTE OF THANKS.

Mr. Mark L. McDonald: I move, Mr. Chairman, that the thanks of this Convention be tendered to each of these ladies for those most beautiful and valuable contributions.

Motion seconded, and carried unanimously by a rising vote.

ORNAMENTAL WILD FLOWERS AND SHRUBS WORTHY OF CULTIVATION.

Essay by C. R. Orcutt, San Diego.

"In all parts of the civilized world, the refinement, innocence, and happiness of the people may be measured by the flowers they cultivate," says an eloquent author. I would add that the wild flowers of a country must furnish a truthful index to the adaptability of that land as a home for the human race, for where they abound, there, too, man may seek for fruitful toil, pleasure, and rest.

Where may lovelier flowers, more brilliant tints, or more delicate coloring be found in greater profusion than on the mountains and mesas, in cañon and meadow, throughout the length and breadth of California? And where may a more perfect earthly abiding place be found for man?

California has probably already furnished to the horticulturist a greater variety of beautiful flowers than any other State in the Union. Foremost among those already introduced into cultivation is the abronia, a trailing plant with prostrate branches, and bearing umbels of sweet-scented flowers. Abronia umbellata is the best known, with its rosy, lilac flowers, and it slightly resembles the verbena. Abronia arenaria, with its waxy, yellow flowers, has also given great satisfaction in cultivation. These grow in great abundance along our sea coast; but other lovely varieties are wasting their sweetness on the desert air of the

Mohave and Colorado arid regions, awaiting the appreciation of man. These plants are especially adapted to dry, sandy, or saline soils, and are excellent to prevent the shifting of sand.

The collinsia, of which we have several species, is another familiar flower in eastern gardens, a free flowering, hardy annual, with flower stalks from a few inches to two feet in height, each bearing several whorls of handsome, vari-colored flowers. The purple and white Collinsia bicolor is one of the handsomest in the genus, and abounds on rich hillsides and in shady places.

Eschscholtzia Californica, with its finely cut, glaucous green foliage, was one of the earliest to receive an introduction into the gardens of the civilized world, and is now everywhere known throughout Europe and America. The flowers vary exceedingly in color, ranging through the many shades of orange and yellow to white; in one form described as greenish, in others almost becoming red. It is usually an annual in gardens, but along the sea coast and in moist situations it becomes a perennial. By some botanists the many different colored forms are considered as species, and for horticultural purposes it may be well to treat some of them as distinct.

One of the beauties of the California landscape in springtime is the massing of color on our hillsides and in our valleys. Acres, and often hundreds, and sometimes even thousands of acres, will be of a brilliant uniform hue, owing to the preponderance in the vegetation of one variety of flower that is in bloom at the time. Usually, however, each flower is confined to a more limited area, and one may wander first from a patch of pure white nodding krynitzkias to a bed of brilliant rosy pink gilias, while just beyond exists a mass of royal purple, the whole encircled by a sea of gold.

What must have been the feelings of the earlier botanists when they first entered upon these confines of Nature's garden. These earlier botanists were able to view the landscape with appreciation as keen as horticulturists, and the gardens of Europe were soon enriched by their labors.

We cannot here attempt to review all the flowers which thus early met with due appreciation, or we should have no space for those which are still asking admittance within the floral circle.

Phacelia Parryi is one of the loveliest of the annuals of Southern California, and a universal favorite among those who have made its acquaintance. Every one who sees it face to face feels an instant admiration for its beauty, and a kind of friendship for it, such as we experience in our intercourse with the pansy and other flowers which confront us with something akin to a human expression.

The plant delights in warm, sunny exposures, on the banks of cañons, among the foothills, in fertile valleys, and on the hillsides. It extends, in San Diego County, from the seashore to the confines of the Colorado Desert, southward to near San Quintin Bay, Lower California, and perhaps beyond. It has an open, rotate corolla, of a rich and brilliant royal purple, well set off by the dark green foliage. Occasionally a flower may be found of a paler color, sometimes nearly white. With nearly all of our native flowers that are normally purple in color, I find albinism a common occurrence, though rarer in some species than in others.

For cultivation, I should call this one of the most desirable of the

many pretty annuals which California affords to the horticulturist. It is capable of most effective display, and under favorable conditions will produce a profusion of flowers for months.

Phacelia Parryi is a lasting memorial of one who has just passed away. Dr. C. C. Parry, by his explorations, has introduced many a plant worthy of cultivation to the world of botany and horticulture. News has just reached me of his death at his home in Davenport, Iowa. To him belongs the honor of introducing the lovely Lilium Parryi, which we all admire. The Notholaena Parryi of our arid regions, a retiring and modest fern, faithfully reflects in these the character of one who made friends wherever he went. Dr. Parry was one of the earliest and best friends of the writer, and his death will be felt by many who have been similarly benefited.

Nolina Parryi, a large, liliaceous plant, is another of our desert perennials worthy of attention—equally as ornamental as the yucca.

Phacelia Orcuttiana bears a smaller flower than P. Parryi, and is white, with a golden center. It is a handsome, showy plant, one or two feet or more in height, and may be used with good effect in a garden or conservatory. It grows abundantly in the mountains of San Diego County and Lower California, and seems to spring into existence wherever a brush fire has devastated a section of the country.

Gilia dianthoides bears a flower which in size and beauty is out of all proportion to the plant itself, which consists only of a slender, wiry stalk, half an inch or so in height, with narrow, inconspicuous leaves; but from this stalk appears one or more rotate, rosy pink flowers, half an inch across. The flower is of such a texture, and is borne so near the ground, that it is scarcely available for any decorative purpose; but a field carpeted with them, as they shine in the morning sunlight, cannot fail to kindle admiration. Under favorable conditions the plant attains a larger size, and forms a dense mat spreading out over the ground. In cultivated fields, or by the roadside, I have found single plants, spreading out in this way more than a foot across, completely hidden by the numerous wide-awake flowers. A single plant would thus form a lovely bouquet of itself; and we may hope that in cultivation it would well repay any attentions paid to its beauty. It is not rare to find a plant with pure white flowers, especially among the foothills. A similar species (Gilia Orcuttii), with white flowers slightly variegated with purplish red, was collected in 1883 on a mountain in Lower California, but has not since been seen. Another equally beautiful species (Gilia bella) was discovered on the high tablelands of northern Lower California among the Piñone pines; and I have since seen it abundantly on the mountains bordering the Colorado Desert. It has the same characteristics as Gilia dianthoides, but is more brilliant and darker, with flowers of a smaller size.

This family (the Polemoniaceæ) has given many of its members to enrich our gardens, the best known of which is probably the Mexican Phlox Drummondii. The mountains of California yield to the botanist some lovely varieties of phlox, as yet, I believe, unknown to cultivation. The State is especially rich in the multitude of forms of Gilias, several of which, like Gilia achillæfolia, G. capitata, G. tricolor, and others, have gained a permanent place in our annual seed catalogues. Many more besides those already mentioned are worthy of a place in our

gardens, and, with their bright, sunshiny faces, must eventually win their way.

The lœselias are closely related to the gilias, and the three alpine forms of northern Lower California are worthy of attention.

The primula, or primrose, family gives us the American cowslip, or shooting-star, the nearest relative in California of the English primrose. Dodecatheon Clevelandi shows itself, generally, in early spring over the hills, mesas, and valleys of Southern and Lower California, especially near the coast. The flowers pass, in different individuals, from clear pearly white, through lovely shades of pink and rose red, into a brilliant phlox purple, and a large field thickly dotted with their nodding heads is a vision of loveliness familiar to Californians. For many years this and other forms throughout the United States have been known to botanists as the Dodecatheon meadia of Linnæus. Within recent years Mr. E. L. Greene has studied our Californian forms, describing several as new species, and naming that of Southern California in honor of the earliest resident botanist in San Diego, Mr. Daniel Cleveland, whose early collections brought many new plants to light. Every child in springtime is sure to gather large handfuls of the fragrant flowers, and each has some pretty name for them, such as rabbit-ears, Johnny-jump-ups, or mad violets.

This flower should become as general a favorite as the cyclamen, which it surpasses in beauty and the ease with which it can be cultivated. The perennial roots are easily transplanted, and no difficulty should be experienced in making it thrive in eastern houses and gardens. In California they may be planted as borders to beds, or grouped in masses, or dotted thickly over a garden as if they were wild. The broad leaves form a pretty rosette before the one or more spikes of flowers appear, and the flowers are admirably adapted for bouquets and for the use of florists.

Lathyrus splendens owes its name to the pioneer botanist of California, the late Dr. Albert Kellogg, whose botanical labors are so well known. For many years this, the loveliest vine native to West America, was lost sight of, and by other botanists the name was considered a synonym of the common lathyrus of Southern California. In the spring of 1888, in the month of April, Dr. C. C. Parry and Mr. C. G. Pringle, two of our most noted American botanists and explorers, invaded the then almost unknown territory of Baja California, traveling from San Diego southward overland to the shores of Todos Santos Bay, thence inland to the then almost deserted mining town of San Rafael, and back to San Diego.

It was my fortune to accompany these experienced botanists, and soon after crossing the Mexican boundary line at Tijuana (or Tia Juana—Spanish for Aunt Jane), we had the pleasure, in common, of rediscovering this magnificent plant in a cañon among the foothills, hanging in graceful festoons, or clambering recklessly over the bushes and shrubs beside a running stream.

With hands and pick the first plant encountered was gently disengaged from its support, and root and flower quickly transferred in triumph to my portfolio. From this time on we found it ornamenting the cañon shrubbery and the hillsides and arroyos with its large and showy clusters of deep brilliant rose-red blossoms, which makes its name so appropriate.

On our return to San Diego we found it transplanted from its native wilds and flourishing, furnishing refreshing shade, and covering a porch with its enlivening green, which harmoniously relieved the brilliancy of its flowers.

In April, 1889, I again found it in the mountains of San Diego, where for miles along the roadsides the bushes were heavily loaded with its brilliant blossoms, and where it had won from the people the very appropriate name, the Pride of California, to which it is fairly entitled by its beauty.

With us it blossoms the second season from seed. I should describe it as a hardy perennial, as it is found in regions of frost and snow, as well as in our more salubrious climate. On New Year's day, this year, while crossing our mountain range en route to the Colorado Desert, I found a few stray blossoms along the roadside, and the succeeding week was stormbound, amid ice and snow, where in April, 1889, I had found it in fullest bloom.

One of the brilliant spring beauties that receives the admiration of both the savage and cultivated races is the Californian pink (*Erythræa venusta*), also known under various names like California Century, but best known under its Mexican name, *canchalagua*. Medicinally, it possesses valuable antiseptic and febrifuge properties, and is in high repute as a bitter tonic and stomachic. It is said to form the basis of the "August Flower," so extensively advertised, but this is doubtful. With the Indians and Mexicans it is used extensively in fevers, and hacienda or rancheria is rarely found without a bunch of the dried plant suspended from the roof.

The plant is from three inches to a foot in height, and when favored by sufficient moisture, branches into a bushy form. The delicate green and rather sparse foliage is completely hidden by the mass of brilliant coloring which soon envelops the plant. The large, rotate corolla is a bright purplish pink, and very beautiful, and no one can resist the first temptation to gather a briming handful of the flowers. A bouquet can be gathered, and the flowers will keep bright and fresh without water for weeks—almost everlasting in character.

In 1884, it will be remembered that we had an unusually wet spring, especially in Southern California, and vegetation grew more rank than I had before or have since seen. In May, the usual time for erythræas to bloom, our mesas and valleys near the coast were covered with flowers, and the canchalagua was in its glory. I then detected, not for the first time, however, but in greater numbers than before, a beautiful white flowered form of this species. From the abundance of material which I sent to the late Dr. Asa Gray, he was at first inclined to consider it distinct. In different individuals the flowers passed from pure white into the most delicate shades of lilac, lavender, and purple, and thence, naturally, into deep purplish pink, to a normally lighter shade. This certainly, like many other members of the Gentian family, is well worth a permanent place in American gardens.

Another noteworthy plant of the same family is the Frasera Parryi, a biennial, with light green leaves, margined with white, which produces a tall panicle of curiously marked, showy, apple green and white flowers, spotted with purple.

Eustoma exaltatum is another near relative, growing from a span to a foot or two high, producing showy, light purplish blue flowers; not

rare in moist situations in the Colorado Desert cañons, where it is very conspicuous when other plants are out of bloom.

The California layia (*Layia elegans*) is a beautiful, hardy annual, forming upright, bushy plants six inches to a foot high, and producing in abundance large single lemon yellow flowers, the rays tipped with white. Of easy culture and very showy, this plant has recently attracted the attention of eastern seedsmen. Sometimes the rays are only yellow near the base, the remainder purple or white, three quarters of an inch long. A purple flowered form was found near Todos Santos Bay, Baja California. Again the rays are sometimes entirely yellow. Layia xanti is found on the borders of the Mohave and Colorado Deserts, and has larger, pure white flowers.

I trust that the other flowers of Northern and Central California will not feel slighted at my neglect of them, since it is rather from ignorance than intention. I have been too busy in wooing their, botanically, more youthful sisters in Southern and Baja California to pay attention to the northern members of our "best families."

There are many other magnificent annuals both known and unknown to fame, but I will now mention a few of our shrubs that are more especially worthy of notice.

Solanum xanti is a handsome half-shrubby bush, from a span to several feet in height. Its dark green foliage is well set off by the profusion of brilliant royal purple blossoms which it bears almost throughout the year. It is found from Cape San Lucas, I believe, to San Diego, and northward. Its perennial roots can be easily transplanted, and I doubt not it would grow readily from the seed.

Among our native California shrubs that have already met with the appreciation due them, I will simply mention Carpenteria Californica, Fremontia Californica, the magnificent Romneya Coulteri, Heteromeles arbutifolia, and Leptosyne maritima, all fully worthy of more extended cultivation than they have yet received.

Our California ceanothi—the wild lilacs of the Pacific Coast—do not seem to have yet received the attention they deserve. They are mostly graceful evergreen shrubs, bearing in springtime a profusion of fragrant and beautiful white or delicately tinted blue flowers. The mesas around San Diego are white in early springtime, the foliage and branches of the shrubs almost completely hidden and disguised by the floral wealth displayed by our commoner species. In February, while among our foothills, I found another coast species in bloom, with its clusters of campanula blue flowers, which, as they grow older, fade first into flax-flower, and then into pearl blue.

The Arctostaphylos manzanita is another ill-appreciated flower, perhaps because it does not yield kindly to man's caresses. Yet it would seem as if some one might coax it into the same graceful customs of growing and blooming as it follows in its native mountains, and it would surely repay, in that case, for all the care and time that might be given it.

The lovely sprays of snow-white flowers, blushing at the attentions of the fast falling snowflakes of February, would have won for it the vote of any beholder for our national flower. It would certainly be an appropriate flower for our State emblem, if each State is to choose its own flower, as some one has suggested, and in that case its near relative—the trailing arbutus—might be allowed to carry off the national honors.

Abutilon aurantiacum is a low, compact shrub, found near the southern borders of our State, and as yet known by a few botanists alone. Its large, velvety, glaucous green leaves render the plant in itself highly ornamental, and, in size, admirably adapted for pot growing. The delicate golden flowers are a fitting crown for its beauty, and lasting, as they do in its native haunts, nearly the whole year through, should prove a welcome addition to this favorite group of plants.

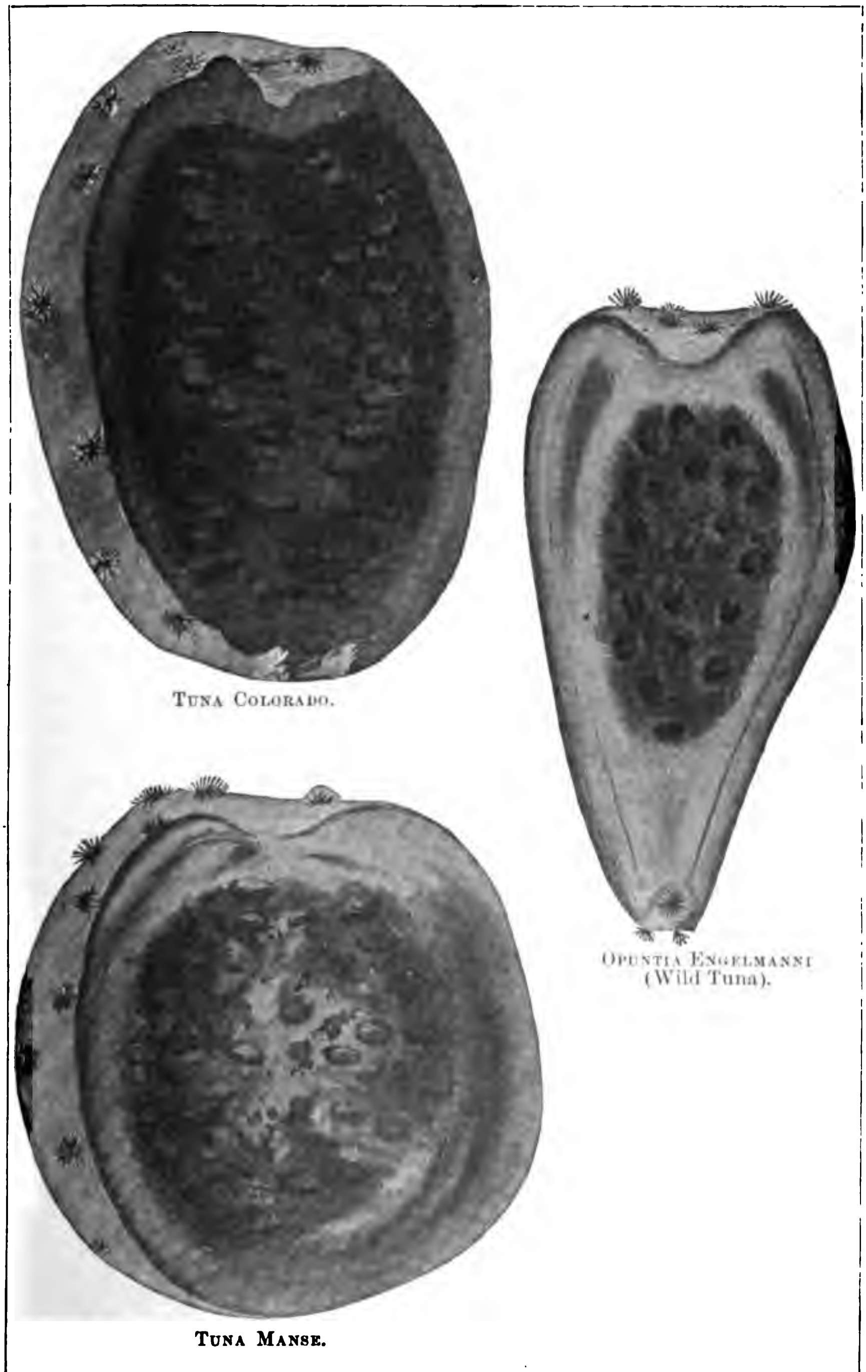
Along the borders of the Colorado Desert there are to be found several exceedingly handsome shrubs which occasionally become small trees. Whether they would take kindly to cultivation I cannot say, but certainly we would not begrudge them any trouble if successful in the attempt. First are the daleas—the embodyment of grace—the several species blending harmoniously with each other in color and form. The airily pendant branches, often leafless and yet not appearing in need of foliage, are beautiful at all times. They are the height of perfection, however, when turned to a brilliant mass of deep indigo blue and purple flowers, laden with sweetness, attracting the bees from far and near. Perhaps the desolateness around them, the dreary expanse of white, shining sands along the arroyos where they grow, add somewhat to their beauty.

Parkinsonia Torreyana, the *Palo Verde* of the Mexicans, is another of these both curious and beautiful desert shrubs or trees. Green, bright, vivid green, from the roots to the tip of each graceful branch and twig, leafless at times, and, like the daleas, appearing to need no foliage, they would be admired above the great majority of the ornamental shrubbery that is planted. At this season they are clothed in delicately divided leaves which lend an added grace to the tree. In summer the foliage disappears and is followed by curious, yellow flowers, which do not detract from the beauty of the whole.

Another shrub which invariably attracts a stranger's attention is the *Hocotillo*, or *Palo Adan* ("Adam's tree"), better known to Americans as the candlewood (*Fouquiera splendens*). It, too, is leafless, except at certain seasons. Like most desert shrubs it is provided with spines, or thorns. It branches out from a short trunk into from a few to one or two hundred stems, which stand out at a slight angle on every side. It is an odd looking thing, not very ornamental at first glance, and is often mistaken for a cactus. It has evidently followed the old maxim: "If you can't be pretty, pray be odd." Cut off one of these curious stems, take it home, put it in the garret right side up with care. Some rainy day, six months afterwards, you may wish to make it into a cane and will hunt it up. The chances are you may find it with a flowering cluster of scarlet blossoms growing out of its top. It has served others in this fashion. You may cut slips and plant them and make them grow. You can transplant young roots with difficulty. Still I do not know of its yet yielding gracefully to cultivation, but I have not myself given it a fair trial, I feel, since I allowed my plants to die.

I believe our Adenostoma fasciculatum is already known in cultivation—in Europe if not in California. Of course so common a shrub as this is with us is not worthy of attention, according to the usual verdict. A near relative, Adenostoma sparsifolium, is found in our mountains, is equally desirable for cultivation, and as yet, I believe, unknown to horticulturists in general. Its delicate, light green foliage is in sharp contrast with its congener, which has very dark green foliage. Both are

FRUITS OF THE CACTUS.



Tuna Colorado.

Opuntia Engelmanni (Wild Tuna).

Tuna Manse.

EDIBLE PRICKLY FRUITS.

evergreens, and of a very high order as ornamental shrubs. By studying the natural blending and contrasting of our wild shrubs and trees in their native haunts, the landscape artist could gather some useful hints, and both of these species of adenostoma would be very useful in his work.

I had intended to review in this paper our beautiful liliaceæ, but time prevents me from doing so. But there is one, which I have recently met—the magnificent Hesperocallis undulata, of our desert regions—that must not escape notice. This fragrant day lily is found in clear sand in the Mojave and Colorado Deserts, and has recently been reported from near Cape San Lucas. It has a large edible bulb, which produces a stalk from a few inches to two feet high, bearing often as many as thirty fragrant white blossoms. The blossom is large, with a green midrib on each sepal, which adds materially to its beauty. The bulbs are one to three inches in diameter, nearly globose, and furnish the traveler in those regions with both food and water if he is so fortunate as to know how to find them. They can be eaten raw, or cooked like other vegetables.

In closing, I wish to call attention to certain native and naturalized fruits—the several varieties of tunas, which have been introduced around our old missions, and are growing wild on our hills. The common tuna produces an abundance of a sweet, luscious fruit, greenish in color, and is what I suppose to be the Opuntia tuna, a native of Mexico. The Tuna Colorado differs but little, except in color of fruit, which is of a rich maroon purple. This, I infer, is the Opuntia ficus-indicus, or Indian fig. The fruit is rather insipid and mealy.

The third variety is very distinct from either of the preceding, and is, I believe, a good species, as yet undescribed by any botanist, so far as I know. Its Mexican name may be adopted for its specific, if it has not been already christened by some Mexican explorer. In that case, we will call it the Opuntia tuna-manse. The fruit is more nearly globose, of a mottled "orange-bloodshot" color.

The flowers of these three vary in color to correspond with the color of the fruit. Our native wild tunas vary greatly in size, color, and taste, some bearing exceedingly sweet, delicious fruits, while others are very sour.

The three photo-engraving cuts accompanying this illustrate the beauty of these fruits, which are useful for making delicate jellies or syrups.

I scarcely need to call attention to the ornamental features of this cacti, as the plant is doubtless familiar to all; but the beauty of fruit and flower in the different varieties is probably not so well known.

OPUNTIA FRUIT AS AN ARTICLE OF FOOD.*

One of the most attractive fruits in the markets of Mexico, and one that is always in demand, is the fruit of the opuntia, or tuna, as it is known to the Mexicans. Both the foreign and native inhabitants consume it, and with many it forms the principal article of food for months in the year.

* Dr. Edward Palmer, in "West American Scientist."

The seeds of some of the choicest varieties sold in the markets of Mexico were obtained, and are now being grown by the United States Department of Agriculture for distribution in localities suited to their cultivation. The tuna of the Mexicans must not be confounded with the opuntias found in Arizona, New Mexico, and Southern California, the fruit of which is not utilized.

What is known as the cactus belt of Mexico furnishes many very fine species of opuntia adapted to cultivation. When brought together, and each variety receives a name, as other cultivated fruits are distinguished, they will severally be sold and esteemed for their respective merits. Then especial growers of this cactus will appear, and new varieties be produced by cross-fertilization and other means, as in our northern fruits.

The potato and tomato, when first introduced, were little valued, because their qualities were unknown; now the world would not care to do without them. When man utilizes the opuntia, then that fruit will be prized wherever known.

CULTIVATION.

Scarcely a plant known to man requires so little care in its cultivation as the cactus. It will grow in nearly any soil, but best in light sandy or gravelly combinations. The opuntia reaches the greatest perfection on the tablelands of Mexico, where owners of estates have assured me that they have realized, beyond all expenses, $3,000 to $5,000 annually from the sales of this fruit and its products.

The opuntia takes root readily when a piece of a plant is laid on the ground, or a little soil may be thrown on the top of a joint, so easily is it cultivated. It will stand considerable cold, and drought does not affect it beyond causing the plant to wilt at times, from which it quickly recovers. The dryness during the most protracted drought seems to increase the sweetness of the fruit.

Give the opuntia one tenth of the care in its cultivation that the peach requires, and it will repay you with a delicious fruit that lasts for a much longer period for market; one better for shipment; one with good keeping qualities. No insects to molest it, no danger from frost, as it blossoms after the time of frost, and protected from thieves by its spines, you can enjoy its fruits unmolested. There are some who dislike all forms of cactus because of their spines, and consider them useless, but this is a mistake. All cacti are useful to animals and birds, and may be utilized by man; and the spines simply prevent their rapid destruction by animals that would greedily devour these succulent growths were they not protected.

REMOVING THE SPINES.

When the fruit of the opuntia is ripe the fine spines upon their surface are readily removed by taking a bunch of grass, or any other suitable thing, and switching the fruit, thus removing easily the downy spines, which, if not removed, would cause a little pain for a short time in handling the fruit. I have seen persons, born among the tunas, catch the fruit suddenly near the summit and wrench them off with their fingers, apparently without suffering any evil consequences. If the spines are not removed at gathering, the fruit will have to be wiped before the rinds are removed, to prevent pain to the operator.

GATHERING THE FRUIT.

There are three methods resorted to in gathering the opuntia fruit—one, with the hands; second, by wooden tongs; third, with a knife. The first method can only be resorted to when the plants are low, or in gathering from the lower branches of a tall plant. By taking hold of the fruit with the fingers and giving it a sudden twist it is at once detached. This is, no doubt, the best method of gathering for market, as there is less bruising, and, if the spines were previously removed, can be at once packed for market, or the "jackets" removed for immediate use. The second method of gathering the fruit, by means of wooden tongs, is, so far as the writer knows, only resorted to by Indians, who gather for their own consumption.

The knife in the hands of an experienced gatherer can be made to detach a great quantity of fruit in a day. It is much used along the tablelands of Mexico on the great estates where the opuntia grows to perfection, and the fruit, by various means, rendered profitable to the owners. The blade of the knife is made of steel and is inserted into the split end of a long, strong stick, the length of which enables the gatherer of tunas to reach with the knifeblade the joints bearing ripe fruit. The plants are often eight to fifteen feet high. The fruit is arranged around the outer rim of the joints, so, when the gatherer brings the knifeblade to the joint, he separates by a quick turn that part bearing the fruit, and as quickly thrusting the blade into the severed part, brings it to the ground, when the fruit is soon denuded of its fine spines and removed. Plants present an odd appearance after the terminal joints have been thus removed, but suffer no injury, and the fragments readily take root and form new plants.

REMOVING THE SKINS FROM THE FRUIT.

It is surprising what a quantity of fruit can be deprived of skins and prepared for the palate by one pair of experienced hands. A thin slice is removed from each end of the fruit; a slit is then made through the peeling along the length of the fruit. The fingers press downward quickly the separated skin, leaving the pulpy fruit exposed in a tempting manner. Thus prepared, the fruit is one of the sweetest, most nutritious, and refreshing of fruits, mealy and juicy, most agreeable for the warmer seasons of the year in the United States. Especially is this fruit adapted for the breakfast table, when the languid body needs something to aid digestion. If kept as cool as a watermelon, it will prove far more agreeable than that fruit, being of a similar flavor with that of the strawberry added, and it is healthier, more nutritious, and longer in season than the watermelon.

This fruit is to be found in the Mexican markets in abundance, and very cheap five months in the year, and is consumed by all classes and conditions of people. Venders are to be seen along all the roads. Along the Mexican Central Railroad the earliest tuna is ripe in June, and the latest varieties disappear in November, and you are offered them in small dishes, with the epidermis removed, a thorn from the mesquite tree being used to carry the tempting morsels to the mouth.

This fruit is finding its way all along the frontier of the United States,

and this winter I saw some fine fruit on a stand in Jacksonville, Florida, for sale.

Americans and foreigners consume this fruit with equal avidity with the Mexican, and praise the flavor. When as well known in this country as in Mexico, it will be utilized to the fullest degree.

NATIONAL REGISTRATION OF PLANTS.

Essay by A. L. Bancroft, San Francisco.

THE NEED OF A COMPLETE AND SYSTEMATIC PLAN OF REGISTRATION.

The generally unsatisfactory condition of the nomenclature and means of identification of fruits, flowers, and plants, is shown by the fact that at nearly every Convention of fruit growers or florists a committee on nomenclature is appointed or has a report to make. Unfortunately, the work of such committees is generally merely local in its influence and is soon forgotten, and but very little or no advance is being made in establishing a general and uniform nomenclature for the entire country.

Those dealing in or having to do with plant life are caused great inconvenience and loss of time and money, for the reason that the names of many plants are not uniform in all parts of the country, and that there is no ready or authoritative way of identifying them. Cases frequently occur where, through duplicate names, ignorance, or dishonesty, purchasers fail to obtain what they expect. The fault may even be their own, but the losses are no less and the situation no less exasperating for that reason. As to the desirability of having one, and but one, permanent and recognized name for an individual plant, all must agree.

If this one accepted name could be decided upon by some central power and be made official for the whole country, it would be the most desirable thing that could possibly be done; but it must be official and final, or it would not be generally accepted and permanent, and would amount to nothing. The names, etc., should, in this connection, be recorded in a series of volumes, to be known as the "American Horticultural Register."

WHAT THE PLAN OF THE REGISTER SHOULD BE.

The register should be planned upon a very broad basis, so as to be permanent and not to require reconstructing at some time in the near future. It should include all plant life, both indigenous and exotic, which grow on the American continent, extending from the north pole to the equator.

By starting separate lists for different classes of plants at the same time, and not attempting any arrangement of the individual plants in the lists, but merely recording them as the names are decided upon and they are ready to be recorded, the lists under each class of plants could be extended indefinitely. The first plant in each list should be No. 1, and the others continue in regular rotation as new ones are added. A system of letters could be used to indicate the class to which the list belongs, and figures to indicate the number of the plant in the list. This

combination of letters and figures would indicate where the record of each particular individual was to be found in the register, and taken in connection with the name would always be the official designation of the individual plant. The register would always afford an official and authoritative way of identifying plants and of settling disputes concerning them.

The register should contain, first, the number; second, official name; third, botanical name; fourth, the popular name and local names; fifth, description; sixth, a short history and a statement of the peculiarities and habitat of each plant recorded; and seventh, in many cases, if not in all cases, a photograph or series of photographic views of the plants. While the reproduction of these views would be too expensive for general circulation or distribution, complete copies of them should be found at least in all of the State Libraries of the country, and in many of the other larger libraries and educational institutions, while a printed copy of the register, without the photographs, should be easily obtainable by all who might be interested in it.

A very desirable feature of this plan would be to have preserved in a collection specimens of all the plants. Where they are small, complete specimens could be accommodated; but, in the case of large trees, a portion of the wood, bark, foliage, and fruit could be preserved. To do this would require considerable room, and a new building, to be devoted to this special use, would soon be required. A very large building is now used for the storing of models of inventions. Should they be considered of more importance, and have a building devoted to their sole use, any more than plant life?

The registration of all known varieties should be commenced at once, and be continued as names are decided upon, and new varieties be registered as they are discovered or originated.

HOW TO ACCOMPLISH IT.

The carrying out of such an undertaking as this, if done upon a sufficiently broad basis, would be too great an undertaking for an individual, a society, or a combination of societies, or even by a State organization. But even if it should be satisfactorily done by them it would then be without official sanction, and would be comparatively ephemeral and valueless. Nothing short of action by the general Government *can* accomplish what is desired. National societies, local societies, and individual societies can render most valuable assistance in this work, but it must be *official* when once done, decided upon, and recorded. There would undoubtedly be active and influential coöperation with any organized and well defined movement in favor of a plan of this kind, by those having a pecuniary, scientific, or general interest in the subject.

Before, however, recording and announcing a name as being decided upon and irrevocably fixed, lists of proposed names with descriptions, etc., should be published from time to time, and sent to societies and others interested, and allow a sufficient time to elapse for consideration, discussion, and to settle all disputed points, before finally determining the name and recording it, and only transfer the names from this list of names proposed to the register when all doubts are removed, and when it can be satisfactorily done.

The natural place for this work to be undertaken is in the Department of Agriculture at Washington. There it could be done, and well done, and neither would it require for its accomplishment very much of the surplus which so troubled the previous administration. Probably an additional officer or two, with a few assistants and some additional room, would in time accomplish it. Each Government on the North American continent should be invited to join in this scheme, and to send a representative to Washington, to reside there for a time and assist in the work, giving particular attention to the plants of their respective countries, to the end that the same work might be made available as an official list for each country represented. In this case all that would be necessary to do to make it as desirable as it could possibly be were it done especially for each country, would be to translate the names of the classes of plants and descriptions, etc., into their respective languages. The classification, system of numbers, etc., would be as satisfactory for one nation as another. The scheme might perhaps be extended to take in South America, and the islands of the sea, or, in order not to lack sufficient breadth, go even still further, and take in other continents as well.

EXCLUSIVE PROPAGATION AND SALE RIGHTS TO ORIGINATORS FOR A LIMITED PERIOD.

In connection with this movement there should be secured, if possible, to the originators of new varieties of fruits, flowers, and plants—but probably by a separate Act of Congress—the exclusive right to propagate and sell them for a limited time. Suppose the originator had the right to enter at a moderate expense his new plant for propagation right any time within three or five years after a tree was fruited or a plant flowered, in order to have sufficient time to test its merits, and then have the exclusive right for twelve years. This would give him two years to prepare stock for market and a full ten years to reap the reward of his laborious research and experimenting. The originator of literature is protected by the copyright laws; the originator of inventive products by the patent laws; and they certainly deserve no greater recognition than the originator of new and valuable varieties of plants deserves to be protected by propagation laws.

No one but an American citizen should have the right to acquire this propagation right in our country; but a citizen should have the right to acquire by purchase from an alien a plant originated within three or five years, and which has not been put upon the American market, and to enter the same for propagation right in his own name, stating in his application or entry how he acquired his title to the new plant.

The purchaser of a *propagate-righted* plant should have the right to propagate it for his own use, but not to sell it except by special arrangement with the originator, nor to give it away. At the time of purchase he should be furnished with a certificate of purchase by the vender, who shall keep an accurate record of the same. At any and all times before the expiration of the propagation right the owner of a propagate-righted variety should be required to prove, by producing his certificate, how he came into possession of it, and that he is lawfully entitled to have one or more of them in his possession, or hold himself responsible for violation of the law. Any one desiring to do so should have the *right* to

purchase any propagate-righted plant at the advertised price, whether he is an orchardist, florist, or amateur.

Protection of this kind would be an incentive to extensive and systematic experimenting, which would, without doubt, result in producing many new and valuable varieties as a blessing to mankind.

RESULTS AIMED AT.

The California State Horticultural Society and the California State Floral Society have each recently elected members of a joint Committee on Horticultural Registration, etc., with power to act and to add to its numbers. This committee is now being organized, and their work is already being planned. If the members of this Convention approve of this movement, I, as a member of the committee referred to, would ask them to discuss the question, and appoint a committee to draft a memorial to Congress in duplicate, asking that this plan be carried out; and that one copy be forwarded to one of our representatives in Congress, and that the other be sent to the committee.

The work of this committee will be neither short nor light, but by keeping at the work assigned them persistently, energetically, and with good judgment, they hope to accomplish results which will justify the time and labor expended upon it. In due time bills will be drafted and sent to our representatives at Washington for introduction into Congress.

ORNAMENTAL TREES AND SHRUBS.

Essay by Byron O. Clark, Pasadena.

In assigning the subject of "Ornamental Trees and Shrubs" a place in the deliberations of this Convention, you give recognition to a branch of the horticultural interests of this State of much importance. Not in the direct line of dollars and cents, as in the great fruit industry, but one that goes far towards making pleasant and beautiful the surroundings of the toiler, be it he who owns acres devoted to fruit growing, or the dweller on a city lot.

In planning the homestead, all the available land should not be planted to fruit trees, merely for the sake of the revenue to be derived therefrom. The temptation for doing so is greater in this southern clime, than in most places. As the orange and other citrus fruits, with their unrivaled beauty of foliage, fruit, and flower, are liable to insinuate themselves into our affections, to the exclusion of many other beautiful shrubs and trees, especially when the possible profits of a single well grown orange tree in the front yard will make more clear money for its owner than the best acre of grain ever harvested in this or any other State. However, if I could have but *one* ornamental tree on my lawn, it certainly would be an *orange* tree, and I give it the first place on my list of ornamental trees, as it is one of the *few* trees suitable alike for planting on the extensive lawn of the country home, or the limited area of a city lot; provided, the soil and other conditions are favorable for healthy growth.

In this semi-tropic climate the tendency is to give preference to evergreen trees and shrubs, and, if properly selected in planting, so as to

avoid the predominating error of planting too great a proportion of coniferous trees, with their formal habits of growth, I would give them the decided preference, as it is possible, with a good selection of coniferous trees, interspersed with broad-leaved evergreens, such as the Magnolia grandiflora, Rubber, English laurel, California laurel, Madrona, Photinia arbutifolia, etc., with the addition of the graceful pepper with its beautiful foliage and red berries, the tall and majestic eucalyptus in its numerous varieties, many of which have the additional charm of handsome flowers, the Grevillea robusta, and other trees of varied habits and foliage that thrive well in this climate, to *create* a landscape that will be a constant delight to the beholder, be it December or June. I am not unmindful of the fresh and inspiring beauty of the maple, elm, walnut, etc., when they take on their mantle of matchless green in the springtime; but I always feel sorry for these friends, when, from October to March, their bare trunks and leafless branches are alluded to as "dead trees" by the people who come among us to spend the winter season, and do not recognize them as things of life and beauty, when surrounded by the evergreen pepper, orange, etc.

There are many gems of beauty among the deciduous trees and shrubs that should find a suitable place in our landscape plantations, and can be used with good effect if properly arranged. They should not be planted in too conspicuous a place; their beauty is of a modest, unassuming type, that will receive its share of recognition from their friends without being placed in the foreground, to be the object of criticism by the average observer, for it requires one whose thoughts lie close to Nature's God to recognize the beauty of the stately sycamore, or the graceful elm, when shorn of the verdure of spring.

The hardy palms are a very important feature of our landscape, and very charming tropical effects can be had when grouped with dracænas, bananas, yuccas, fourcroyas, etc.

Among the best of this class of plants I would recommend the phœnix, or date palm family, with its many varieties, as very graceful and ornamental, quite hardy and good growers.

Of our native palms, the Washingtonia filifera is more largely planted than all other kinds put together, largely owing to its easy growth and not being so expensive as choicer kinds, and it is especially suited to avenue planting, being the best palm for this purpose. Erythia edulis, from the Guadaloupe Islands, and Erythia armata, the blue palm, are both choice varieties, and will be popular when better known.

The Chamærops excelsa and humilis, and Cycos revoluta, or sago palm, from Japan, are hardy and very handsome palms, and should be in every collection where one has a variety of palms. The Latania borbonica is a beautiful fan-leafed palm, but needs to be planted in a partially shaded situation or its leaves will sunburn. There are many other palms hardy in this section, but most of them are better suited to the amateur who can give the special attention required to meet with satisfactory success.

It is not advisable in this article to give a long list of trees and shrubs which are suitable for our climate. Such a list can be had from the catalogue of any reliable nurseryman on this coast. With the aid of such a catalogue, and a personal study of the trees growing in the grounds of our older improved places, one can obtain a very good idea of what is best suited to his needs. Do not plant too great a variety;

do not expect to make a complete arboretum on a city lot, or a ten-acre homestead. Select a few choice specimens, and give plenty of room for development. Many choice and rare trees are ruined by planting too thickly. When you plant, have in mind the size the tree will be ten or fifteen years hence; do not plant with regard to present size. Do not touch your tree with a knife, unless you are sure you know what you are about. More trees of all kinds are injured by injudicious pruning than by any other one cause. What beauty is there in an evergreen which has the appearance of a "haycock stuck on a pole?" People who plant trees seem to think the next important thing is to prune. To such, I would say, take Mr. Kinney's advice: "Go away from home until the spell leaves you."

FOREST CULTURE.

Essay by ABBOT KINNEY, Lamanda Park.

We are all socialists or nationalists to the extent of admitting that certain things are of the nature of monopoly. These things we confess can only be properly administered for the whole people by the people's representatives. Of these there are the public defense, taxation, the Post Offices, etc.

Some countries are behind in the control of such monopolies, as Turkey, where the taxes are farmed out to private contractors; while other countries are ahead, as those managing the telegraph or the railroad. So, also, there is the supplying of water, or of gas, in some communities, or the sale of tobacco, as in France, or of alcohol, as in a city of Sweden, that is made a public monopoly. Some communities control education, sanitation, diet, or drink, etc., while others leave all things alone. About the advisability of Government control of all these, except the national defense, taxation, and the Post Office, there is still dispute by competent persons.

There is one interest, however, managed by the people of most civilized countries, but not in this, about which there is no dispute by the competent. All agree that from its nature it must be a Government monopoly. This interest is forestry. Every civilized country, except the United States and England, have nationalized their forests, or placed them under Government control. England is so peculiarly situated, both as to topography and climate, that the importance of forestry has not been forced upon it. England has, however, a fine forestry system for India. We may, therefore, be said to stand alone amongst civilized countries in our neglect of forestry. Even pioneer countries like Canada and Australia have forestry systems, while we have none.

The forest is the farmer's friend. These friends are often far apart, so far, perhaps, that the relation of the one to the other is lost sight of. It is not a self-evident fact that cutting or burning the forest covering of a watershed will be to the injury of farmers fifty or even a thousand miles away, or that such forest destruction may also be the destruction of these distant farms. The study of man's experience is required to demonstrate the interdependence of agriculture and forestry. But the demonstration and proof of the importance of forests to farmers is not

enough to utilize the knowledge of forest management in the whole people.

The individual control of landed property deemed useful in other interests can, upon no theory, be accepted as good for forestry. The owner of a forest in the Sierra may find it individually advantageous to denude an entire watershed. We know that extensive denudations of steep watersheds result in floods during heavy rains, destructive to any valley lands within its high-water area. Thus the lumberman may derive a personal profit from a forest destruction that by and by will destroy whole farming districts. The ratio of his profit to the farmers' loss may be as one dollar to a million, and still the individualistic system is incapable of stopping or even blaming him. The realization of the relation of forests to farms has forced foreign Governments to place the forests under public control. This has not been done upon theoretical grounds, but as a sequence of exceedingly expensive experience. Before forestry was adopted as a Government policy, we learn that the fertility of whole countries was diminished or destroyed as forests were cut off. Palestine, or the Land of Canaan, is described as a land flowing in milk and honey. We also read that very fine timber grew in the mountains, including the celebrated Cedar of Lebanon. At the present time there remain of these cedars a few specimens, visited as curiosities.

No forests remain in Palestine, and, excepting a few little nooks and corners, no fertility remains in Palestine.

The granary of the ancient Roman world was North Africa. At the time of its great productiveness, the mountains which back up the plains were forested. From them came the timber for the great fleets of Carthage. The one condition has disappeared with the other. Many countries of the ancient world have had this experience. Once supporting large populations, are now nearly deserted; once fertile, now deserts. One district after another went through the same experience, that is, allowed the destruction of the forests on its watersheds, only to see the production of the valleys diminished.

The old records tell us, for instance, that logging corporations once did a thriving business on the River Durance, in France. Now its mountain watershed is bare, the channel of the stream has broadened so that no boating is possible. Its bed varies between a wild waste of bowlders and sand in the summer and a wilder waste of turbid torrent during rains.

In this valley alone more than two hundred thousand acres of the famously fertile Provence have been totally ruined. Out of these recurring experiences grew the recognition of the relation of forests to farming. Out of the feudal preserves for hunting and pleasure grew the modern forest system for practical purposes. The pleasures of the few maintained certain districts forested. It was noted that the watersheds of such districts were not subject to either the destruction of drought or of flood, as were those of denuded watersheds. It was also observed that after a certain proportion of forests was destroyed, the productive line of plants, such as wheat, and of trees, such as peaches, receded further south. This indicated either greater extremes of heat in winter or spring, allowing premature blossoming, or of cold at the same season, fatal to the productive character of the plant, or else of extremes of moisture and of dryness of the air or soil, equally detrimental, or extremes of wind, or all of these. At last a rule has been formulated, that

a certain proportion of the area of a country must be maintained in forest for the highest productive capacity of a country. That is to say, a given district, which we will call one hundred square miles in area, if all under the plow, will not produce so much as if 25 per cent of it be in forest and only seventy-five under the plow. Besides these economic reasons for forestry, there are still others, to only one of which I will allude. This is the connection of forestry with health. I believe that I am accurate in saying that, other things being equal, a forested district is always healthier than a denuded one. We know, at least, that many districts formerly forested, or partly forested and then healthy, are now bare of trees and unhealthy. In some cases, as in portions of Greece, Macedonia, North Africa, and Italy, such deforested districts, once fertile and populous, are now deserted and desert. We have a reasonable presumption that it was forest destruction that produced these unfavorable effects by the results of replanting trees by the French in Algiers, and by the Italians on the notorious Campania. In both cases the excessive mortality from malignant malarial maladies has diminished or disappeared.

These records of other countries and of other times may seem far off to Americans. If this is the case, they can study the effects of forest destruction in the Eastern States. By such study can be learned the fact that in America forest destruction is followed by diminished springs and summer flow of streams; by increased destructiveness of winds; increased force of frost; increased force of flood, and increased death rate of the people. Accompanying this is a retreat south of the productive limit of many useful plants and trees; a diminished length of life of fruit trees; a general diminution of the productive returns of land per acre, etc. The census shows some of these things in a manner that should attract more attention than it does. Whether these unfavorable accompaniments of forest destruction are in any way due to deforestation is disputed. The weight of testimony to me, however, seems to point to a large, if not exclusive, influence of forest destruction upon these conditions.

In the older States this view is accepted very generally. Nearly all the northern and central States now have forestry societies or commissions; there is a national forestry organization, and a number of periodicals devoted partly or wholly to forestry. The Federal Government has recognized forestry by adding, some years ago, a forestry division to the Department of Agriculture. This is now under the able management of Mr. B. E. Fernow.

This gentleman, together with Commissioner Ensign of Colorado, Sargent of the Arnold Arboretum, Harrison, the Secretary of the National Forestry Association, Messrs. Beaver and Binney of Pennsylvania, Joaquin Miller and Ira G. Hoitt of our State, Mr. Eggleston, and many others, are doing yeomen service in trying and working to create a practical forestry system in this country. No State where the mountain forests belong to the Federal Government can really do much in the protection of such forests, nor in their preservation as forests. The action must come from Washington. As States in this situation, California and Colorado take the lead in forestry matters. Well they may. These States have all the conditions that command a conservative cutting of their forests.

The forests are upon the mountains. The rainfall is practically lim-

ited to the winter season; it is heavy in the mountains and light upon the plains. The mountains occupy large areas, and from them flow the streams and springs from which may be derived a permanent and perennial supply of water for domestic or agricultural use. The climatic conditions are such that, to secure large or regular returns from the soil, irrigation is found essential. Hardly a district is free from the danger of torrential floods, should the high mountains be denuded of their trees or brush. None could be free from the increased wind action that would arise from the bare mountain surfaces, nor could any escape the increased extremes of temperature that we must expect with diminished forest area. In the first report of the California State Board of Forestry, an examination was made upon the effects of tree or brush destruction upon watersheds. You will find there detailed accounts of a number of watersheds of this State where extensive denudation, due largely to fires, had occurred. In these instances, the summer flow of water was reduced, while the flood action was increased. In a number of cases, torrents arose from burned watersheds where none had previously existed. Some of these instances were in the San Gabriel Valley, within easy access for such Thomases as may be among you. I can direct any interested person to these new torrent beds, and also to old residents who knew the country before they existed.

It may, perhaps, be well to say that as far as summer flow of streams or springs is concerned, there is still doubt as to whether the deciduous trees usually found near water have a favorable or unfavorable effect upon its summer flow. There is, however, no doubt about the effect of trees and brush upon the watershed itself. In Southern California there is little forest denudation due to cutting, and this is confined to a few localities, such as San Bernardino, San Jacinto, etc. Our forest fiend is fire. In the lime vat it is the flood that makes the fire; in our forests it is the fire that makes the flood. Forest fires produce conditions which must be followed by floods, with even ordinary rainfall.

The increased erosive power of our streams is general; it cannot have escaped the notice of any observant person. The old streams cut their banks more than they used to do, and new gullies and barrancas are appearing in many places. In some localities the damage from this cause is so extensive that diking districts are spoken of, to be operated on the same principle as the Wright irrigation bill provides for the irrigation district, the purpose being to put in piling to confine the streams to their beds and prevent the erosion and destruction of the bottom lands. Whether this increase of erosive power of our streams is altogether due to brush burning or forest destruction upon the mesas and mountains may be doubted, but that it is largely so may be surmised from the following data:

Given a certain area of watershed and a certain rainfall; the delivery of the water will be more rapid as the area is bare of brush or forest, and slower and more continuous in proportion as the area is forested. Thus we will suppose that at the outlet of a given watershed forested, with a given rainfall, there would pass one thousand cubic feet of water per second, requiring thirty days to deliver the rainfall. If we then suppose this watershed to be bare, with the same rainfall we will have ten thousand feet per second passing our given point, delivered in three days. Besides this, from the area where forested, little or no detritus or soil can be carried by the water. but where bare this will be consider-

able. It amounts in experience here to 20 per cent of detritus in the total volume of flood water, in a grade of one in sixteen, increasing or diminishing with the grade, and also influenced by the nature of the watershed. We must, therefore, add this element to the volume of our flood waters from the bare area. We then have ten thousand cubic feet of water and two thousand cubic feet of mud, or a total of twelve thousand cubic feet of volume passing our given point from the bared area as against one thousand cubic feet of clear water from the forested area.

Water charged with detritus has a greater erosive power than clear water, from two causes:

First—The sand, gravel, and bowlders increase enormously the cutting force of the water charged with them. The effect of such detritus upon the cutting force of the water is similar to that of a blast of air charged with sand. The cutting force of clear air is imperceptible, but when charged with sand it is very great. I have seen the bark of orchard trees destroyed on the windward side by our sand-laden Santa Anas (winds). The eroding power of clear water is equally imperceptible, while when detritus filled it becomes difficult to control.

Second—Because the detritus-carrying power of water depends upon the grade of its flow. Thus, torrents originating upon the steep watersheds of our hills or mountains, and there charged to their full capacity, must drop some of their load when passing to the lower grades of the valleys.

Streams of this character, therefore, fill their channels and have an everlasting tendency to change their beds. The observer will notice them zigzagging across their beds, now feeling for an escape on one side, and now rushing roughly to attack the other. Cutting everywhere, it picks down the bank in one place to deposit its ruins in another. The finer and better parts of the soil are easiest held and transported, and so proceed to the sea, while the sand is dropped in the ever widening bed at the first opportunity. So our bottom lands, rich and fertile, diminish, and the sand wastes widen and send their arid glitter to the sky. Now that we are upon this topic it may be well to say a word or two about palliative measures. Wingdams at frequent intervals have been suggested for protecting the banks of the Santa Clara; for the San Gabriel and Los Angeles Rivers, piling on each side to the sea is spoken of. The first system to be effective would require quite as much piling as the second, on account of the shifting character of all detritus-carrying streams.

The disadvantage of both is the heavy first cost of doing the work well and in a reliable way, and the heavy cost of maintenance, one item of which would be the short life of piling alternately wet and dry in sand. I made a small experiment in protecting bottom lands this year in a cañon. A ditch was dug about two and a half feet deep on the side of the land to be protected and in the bed of the stream. Into this was placed brush and willow cuttings, the whole wired together and fastened to fixed objects or posts. This was done last October. It has formed a perfect protection, while land above, below, and opposite, has been washed off and lost.

The willow cuttings have started to grow, and we expect that when the brush has rotted we will have a live dike, much stronger than the present one. Whether the stream would have cut under my line, had both sides been treated the same through the scouring effect such con-

finement usually has, I cannot say. We know by the experience of the San Gabriel and Los Angeles, that willows on the bank of a stream will not stop cutting. On a level with the stream, however, they are not cut out. On the contrary, their effect is to arrest or slacken the flow of water amongst them, which results at once in the waters dropping the detritus it carries and filling in.

The vital importance of finding a protection for our bottom land, warrants a trial of this willow dike scheme upon a scale that will show whether it is of value or not.

The thing we should all unite on, is a preservation of the watersheds of our springs and streams, both to insure the perennial supply of water for summer use, and to arrest further devastation by torrents and floods.

It is an inappropriate moment to go into the full detail of forest effects upon rainfall delivery, upon climate, and upon health. The facts are already familiar to most of you.

It will be sufficient to give a summary of what is being done in foresty in California, and of the conditions which make a national foresty system essential.

The two reports of the Forestry Board are valuable. They have been sought from the four quarters of the globe, and applications for them still come in, both directly and through booksellers. In praising these reports, I do not praise my own work, for, with some insignificant exceptions, I was merely the editor for the scientific experts employed by the Board. These engaged in the work more from enthusiasm and love of the subject than from any compensation they received.

The first great work of the Board was the undertaking to stop the fires in the mountains and the illegal cutting of timber from Government and State school lands. In regard to fires, the results have not been satisfactory. The weight of testimony, however, is that these destructive agencies have been diminished, and that the people are much more careful about them than formerly. The illegal cutting of timber has nearly ceased. The Interior Department took this matter up, and our State agents accompanied the Federal agents in their crusade against this abuse. The first results were Government actions to cancel patents for forest lands obtained by fraud, as in the case of the great Scotch corporation in Mendocino County.

This hiring of men to enter lands, nominally for themselves, in reality for syndicates and corporations, and contrary to law, was diminished if not stopped. Other actions were brought to recover lumber illegally cut from Government lands by corporations. In some cases these suits involved hundreds of thousands of dollars, as in that of the Sierra Lumber Company. In all these cases of timber stealing the State school lands were involved as well as the lands of the Government. The State agents took evidence at the same time with those of the Government. Everything was complete, survey of land, timber estimated by stumpage, names of witnesses, etc. The first case was sent to the State authorities at Sacramento to prosecute, as a test, and recover a large sum from solvent parties for the schools. The evidence and the witnesses were the same as those in a Government case against the same parties, in which the Government received a verdict. For reasons which are unknown to me the State authorities refused to prosecute or to allow the Board of Forestry to prosecute in the name of the State. The statute

of limitations has now run against all those claims, and the schools lose forever the money to which they were entitled. The sums in the aggregate, by the report of the State's special agent, would have paid the expenses of the State Board of Forestry from its creation several times over. The general effect of these activities was a rapid and extraordinary increase in the sale of Government forest lands, of State school lands of the same character, and a practical arrest of illegal timber cutting in any large way.

The second principal effort of the Board was to encourage and aid tree planting throughout the State. To this end the Board distributed tree seeds for experiment in the different climatic belts of the State, with such information for their treatment as was available. This entailed an immense and expensive correspondence, that with the Board's division of forces became almost unmanageable, and after all the results were highly unsatisfactory. The record of tree adaptability which it was intended to give to the whole people was not obtained. Some parties never planted the seeds, others failed to make them grow. Still others, growing the trees, lost their names. Some sold out and moved away, and some completely obliterated any record by dying. A different system had to be devised, and forest experimental stations were proposed. Through the public-spirited generosity of General John Bidwell, Senator Caminetti, Judge Widney, Dr. Wills, Hancock Johnson, E. L. Mayberry, Senator John P. Jones, Colonel R. S. Baker, and a number of others, experimental stations were offered to the Board of the aggregate value of from $75,000 to $100,000.

The stations included nearly every climatic belt from Chico to San Diego. For reasons that are doubtless good, the Board did not accept some of these stations, and abandoned others already accepted. They still have the stations at Chico and at Santa Monica. The Chico station was given by General Bidwell, and is a beautiful and valuable piece of land, with a living stream at its side.

The station at Santa Monica, given by Senator Jones and Colonel Baker, is a remarkably valuable one. In the first place, it is a lovely spot. The land is partly rich, alluvial bottom, in the picturesque Old Cañon, at Santa Monica, and partly mesa, under the mountains. Its climate is of the most favorable for propagating. Nothing, I believe, which has grown anywhere in California has, as far as tried, failed at this station. Its natural attractions and mild climate will enable the forest officers to make of it one of the most complete, beautiful, most interesting, and most valuable tree plantations in the world. The tree distribution for experimental purposes proceeds from this station. The information which can be tabulated from experimental tree stations may be made of great use to the people and save years of time and wasted effort in desultory work, while encouraging, by a fair certainty of results, tree planting in localities where it is most needed.

More reliable information, in regard to trees suited to our more arid climates, is required, and it is to be hoped that the Board will enlarge, rather than curtail, its efforts in this line.

The third principal aim of the Board of Forestry was to secure a withdrawal of the Government forest lands in the mountains of California, and the creation of a forestry department to manage them. Under it the ripe timber would be cut, while a new growth of the valu-

able kinds would be insured and protected. Fires and over pasturage and waste would be stopped, and the watersheds protected.

In this work memorials were circulated and sent to Congress. A forestry bill was gotten up and introduced into Congress by Colonel H. H. Markham, and an extensive correspondence with those interested in forestry throughout the States maintained.

Amongst other things, the State Legislature passed a concurrent resolution requesting the representatives of the State, and instructing the Senators at Washington, to secure the passage of forestry legislation in the line advocated by the Board of Forestry. One rather striking commentary on the representative character of the Federal Senate, which, in theory, is supposed to represent the States in their sovereign capacity, was the fact that neither of the ambassadors of California to that august body paid any attention whatever to the instructions sent them by the State Legislature, whose servants they were supposed to be.

The demand of our age is condensation and brevity. In response to this, allow me to present to you the forestry question reduced to its elements:

Forestry is the science of forming or of utilizing forests, directly for their products, indirectly for agricultural production from unforested lands.

It has been found that in some localities a proportion of land in forest is essential to good sanitary conditions. It has always been found that a certain proportion of land in forest permits a larger agricultural output than where less or no forests exist. This proportion varies, but is, as a rule, about one fourth of the total area.

Undue forest denudation diminishes agricultural returns per acre, and tends to sterility. The causes are forest effects upon rain distribution, rainfall delivery, humidity, temperature, and winds.

In mountainous countries all these effects are increased in intensity. When the seasons are divided into wet and dry, forest destruction increases torrential action during the wet season and drought during the dry one.

A supply of ripe timber may be cut for the use of the people from forests without any diminution to the forest area, or to the utility of the forest as climate and stream-flow regulators.

The new growth of forests may be maintained of useful kinds of trees instead of scrubs, as is often the case, without forest supervision.

Every forestry department controlling national forest lands, as those of France, Germany, Austria, South Australia, India, etc., is a source of revenue to the State, not a source of expense.

The material interests of California, as of all the country west of Colorado, call for an early establishment of a national forestry system.

Individual interest cannot be relied upon, because the forest owner will not manage his forest in the interest of other land holders engaged in agriculture. The time required for securing a forest crop is too long to tempt men to care for a forest area of mountain once cut off.

Government ownership of forests without any system of care produces robbery, waste, fire, over pasturage, and ruin to the forest. This is the present condition over large areas. It should be changed. The policy commended by reason of experience is a withdrawal of all Government forest lands from sale until, by examination, it shall be ascertained what the permanent line of forest should be in any district and

the establishment of that line, then the organization of foresters to protect the forest from fire, etc., and to sell under proper regulation the forest products.

To California forestry is of paramount importance. It is especially so in the portion of the State south of Marysville.

It is time that the farmers roused themselves and made a fight for their forest friends.

No forests, no farms. The pine tree sings in the Sierra a song that is echoed in the rich rustle of the grain on the distant plain.

Let us not forget, then, that, though so far apart, the interests of the plain are entwined with those of the mountain, and that without forests we may also be without farms.

DISCUSSION.

Mr. Clark, of Pasadena: If I may be allowed an explanation, I would like to say one word in defense of the stand I took on plants. I didn't say, unqualifiedly, "No pruning." I abjured the idea of constant pruning. In judicious pruning, I fully agree with Mr. McDonald. This, I think, is right. Constant pruning is what I condemn, and I repeat what I said in my essay, that there are more trees injured in California to-day with the pruning knife than by any other one cause, unless it be the scale bug, and I can prove it by driving around the country. I speak (as my essay shows) of Southern California, as a standard. Speaking from my own experience with regard to the natural growth of trees growing on the hillside in the sun, or the shady side, they all have their branches distinct, and Nature does it. Take the Magnolia grandiflora; if it is constantly tipped with the pruning knife, it will not make a good tree. I can show good trees that are not so pruned. So through all my ornamental trees, I repeat what I said in my essay. What is the beauty of a tall tree with a long, narrow body? It spoils the beauty. It is not Nature's way of growing those trees.

With regard to planting trees about the house. I would not plant an evergreen near the house. But I do repeat that the evergreen should be placed in the background and the deciduous in front. But everything is reversed in California. We have got to start a new rule in landscape gardening, we might say. The deciduous tree in California must be set in the background, where it will not be too conspicuous when bare, but where its beauty can be brought out when it is in foliage. I have heard it said time and again, in the beautiful grounds of Mrs. Jeanne C. Carr, of Pasadena, which is one of the finest in the world, I had people ask me, "What is the matter with those trees from November to March; beautiful elm trees, all in fine, thrifty condition; but what is the matter with those trees?" There are people from the East who come here and expect to see things green in the winter time, who know those trees, and yet ask what is the matter. I say we can place our trees so as to make a beautiful effect the year round on the plan I suggest. The elm is beautiful in the spring, but is it in the winter time, in California? It drops its leaves early in the fall and starts late in the spring. I say those trees should be placed in the background. Taking the whole class of evergreens and deciduous and planting them together is not right, for Southern California at least.

I move that the plan suggested by Mr. Bancroft be adopted.
Seconded and carried.
Adjourned until March 14, 1890, at 9:30 o'clock A. M.

FOURTH DAY'S PROCEEDINGS.

MARCH 14, 1890.

The Convention was called to order at 10 o'clock A. M., Vice-President Buck in the chair.

MR. BLOCK: If I am in order, I would like to bring up a subject spoken of yesterday, which was adopted by a mere motion, with reference to the abolishing of the name of French prune. If you will allow me, I will offer a resolution to take the place of that motion, and that will cover the subject, and I hope it will be adopted now:

WHEREAS, We are Californians, and our fruits are recognized in all the leading markets of the United States as superior to the imported variety, especially in the matter of prunes; therefore, be it

Resolved, That we, the State fruit growers of California, in Convention assembled, urgently recommend that all growers, packers, and others interested in the prune, do drop the name of "French prune" and all other foreign names; and that hereafter they be called "California prune."

Carried unanimously.

TABLE GRAPES.

Essay by R. B. BLOWERS, Woodland.

My subject, "Table Grapes," is a very large one, and in order to trespass as little as possible on your time, I will treat the subject from the standpoint of shipping grapes for the eastern market.

There are several things necessary to consider if we desire success in this line of horticulture. We must grow the particular varieties that have keeping qualities, and have also an attractive appearance sufficient to make them successful as a market fruit. Flavor is the next consideration. After having arrived in the eastern markets in fine condition, and sold on their good looks, their eating quality should be so excellent as to create a demand for more. In order to produce all these results a proper selection of climate, soil, and varieties of grapes must be made, and the grower must keep in view all the conditions necessary to success. A deep, rich, sandy, clayey loam, well underdrained, and a warm, dry climate seem to fill the conditions. Pruning must be in accordance with the habits of the vine. Overbearing must be avoided, as color is *absolutely* required, and is only obtained in perfection when the proper balance is kept between leaves and fruit. Color, keeping quality, and flavor all go together, and the treatment of soil and vine producing one, all things being equal, produces the other. Irrigation in winter when winter rains are light, and June or early July irrigation supplies the proper conditions, because a vigorous growth of vine during the spring and early summer exhausts the moisture rapidly from the soil. This exhaustion is hastened by the moisture receding downward and a con-

stant evaporation from the surface of the soil, as well as from the leaves, there being but little condensation under the cultivated soil, owing to the heated condition of the ground during July and August. But during this period a strong, healthy flow of sap must be maintained to give the fruit a perfect development, because if there is not enough evaporation from the leaf to keep it cool, there will be more or less sun scald. There must also be a surplus of sap, in order that a part of it may return from the leaf, after being eliminated, to the fruit. In case of lack of moisture, from overdry soil, or too many grapes for the vine under its conditions to carry, it will be found that the fruit is under-colored, insipid, and owing to a lack of full development, has *not* the best carrying qualities.

If the grower will carefully go over his Tokays (I speak of them, as they frequently lack color and are the most important variety) after the berries are set and half as large as a shelled pea, and thin out by cutting away bunches likely to interfere with each other, and especially cutting off the lower one third of very large bunches, he will have nearly as many pounds of grapes suitable to ship, and a larger, better colored, and more profitable crop.

VARIETIES.

Several early kinds are used, of which the Chasselas, Fontainebleau, and Sweetwater take the lead. Heavy shipments are not made until Tokays and Muscats are ripe. The Tokay is by far the most popular grape. The Muscat is not much called for east of Chicago. The Cornichon and Black Morocco are in good demand and have good carrying qualities. The latter, like the Emperor, must be pruned long, as the first and second buds rarely produce first crop bunches.

The Emperor, like the Tokay, is a favorite in the market, but does not fruit over as extensive a range as the latter, being a shy bearer in many places, and never as heavy a producer as the Tokay, but is a better keeper than all others except the Almeria. The past season carloads were shipped from Yolo County, after having been exposed to five or six inches of rain, to Chicago and New York, selling in the last named city at auction to average over $6 per double crate. The Almeria is imported in very large quantities from Spain, and is a favorite, on account of its keeping qualities, in all of the eastern markets. It is a shy bearer in Yolo, where I have grown it for twenty-five years. It should be tried in all sections of California, and if the proper location is found where it will produce equal to Almeria, it will be a very fortunate acquisition to that locality.

The proper methods of picking and packing are of the greatest importance. Grapes should be picked after the dew is off the vines. The picker should cut the stem with a sharp knife, holding it with the other hand, and carefully place it in the picking box stem upward, filling the box only about three-fourths full. The grapes should not be exposed to the light or heat of the sun, but hauled as soon and as carefully as possible to the packing-room; there stacked up in such a manner as to give complete ventilation. They should remain there twenty-four hours; then, it will be found that the stems are wilted and flexible, and they can then be handled softly without breaking the skin at its intersection with the stem.

The packing-room should be light; the clippers arranged on one side of a long table or tables, the packers on the other. The clippers take each bunch by the stem, carefully cut off all imperfect or unripe grapes, then carefully lay it on the table. The bunches should be mutilated as little as possible. Then the packer, using a form with movable bottom, places the largest bunches in the form, filling the top, and covers with smaller bunches, then places the basket on the form, pulls the form partially off the table, places the right hand under the form, the left on the basket, raises the movable form until the grapes are in the basket, turns the left hand down and the right hand up, then places the thumbs on the movable bottom, and with a slight pressure removes the form with the fingers. This leaves the grapes properly adjusted in the basket. The attendant places four baskets in the bottom of the double crate, then stacks them (the crates) up as high as convenient, and places in a cool room an equal amount of packed baskets for further curing.

When the shipment is nearly done the crates are filled and nailed. By this time the stems are sufficiently cured to permit enough overweight to equal the evaporation in transit, so that the consumer can have five pounds net per basket. There should be from four to eight ounces overweight in each basket, as forty pounds net is the approved weight in market. If the packer is found sending good full weight, it is remembered by dealers; the reverse is also found true.

As near a uniformity as possible for each market is desirable, and in *no* case send poor fruit to eastern markets. Handle by stem in all cases where possible, and thus retain the bloom, as in this manner alone will the market and keeping quality be retained. Carry to the car in a spring wagon or its equal—a heavy wagon with a foot of straw in the bed. Have a heavy cover over the crates in transit to the cars. Do not pile the crates upon an open platform exposed to the heat of the sun. A disregard of these small points many times forbids success.

PRUNING THE MUSCAT GRAPE.

Essay by Gustav Eisen, Fresno.

It is not my intention to read you a long and exhaustive essay on the pruning of the Muscat vine; my remarks will be few and short. Not that the subject is not one of great importance to the raisin producer, but because my object is to bring out the views of the various raisin producers here, and to call forth a discussion as to their various methods and ideas. Until quite recently, the Muscat vines, even in our principal raisin vineyards, were pruned without any special attention to what was required, and without any great knowledge of what would be the result of long or short spurs, of high or low standards. A great many of our growers either pruned just as their neighbors did or as they happened to do the first time. Others, again, pruned with a view to get a large crop, or thought they did; some, again, had other ideas in view and exceptions of their own, afterwards more or less realized. During the last few years much attention has been paid to the various systems of pruning Muscat vines in the raisin districts of the State, and coupled with our own experience we have that of the Spanish growers, brought

here by a gentleman who lately visited Spain. While it cannot be said that we have at last settled upon the proper way to prune, we have at least made enough progress to realize that pruning is not a child's play, but, on the contrary, of the utmost importance, both as regards the coming crop and the future and continued welfare of the vine. Should we ask ourselves why we prune, we might establish the following points for consideration:

1. To prevent the vine from getting out of shape.
2. To prevent overbearing.
3. To give larger berries.
4. To keep the vines healthy.
5. To produce as sweet grapes as possible.

There may be other points to be considered, but I believe that these are the most important ones which every raisin grower should take into consideration before he puts the shears to the wood, or, as is only too often the case, allows some one else to do it. We all understand the necessity of keeping the vines within proper bounds. If not pruned with this point in view the vines will grow larger every year, until at last the whole space is occupied by branches, which again will not allow the proper cultivation of the soil. Pruning is therefore a necessity from this consideration alone. The Muscat vine, like so many other varieties, has a tendency to throw out branches from the end buds only, no matter how long is the spur left—it is a real climbing vine. For instance, if we leave a certain number of eyes on a spur, out of the whole number of eyes only the two eyes at the end of the spur will sprout and produce canes. The other eyes will remain dormant. This is a very simple fact which every planter should realize at the very first pruning of his vineyard, in order that the vines from the very start may assume the shape that is best adapted to the purpose for which we raise them. Still, there is not a vineyardist in fifty who does not make an error the first time he prunes, not realizing the consequences. The desire to get big vines quickly induces the planter to leave more wood the first season, the effect being that the vines will be too high or too wide. The coming season the same error is repeated, and when the third or fourth year comes, and the error is realized, it is only with difficulty that a change can be made. If, on the contrary, the pruner from the very start had realized what was required, it would have been a very small matter to have so shaped the vines that no severe afterpruning would be necessary to put them in shape. These remarks are not, of course, directed to those growers who have had years of experience, but to those only who are starting in the vineyard business for the first time; and, judging from the reports in the papers and from my own observations this spring, this class of growers is not a small one. Twenty thousand acres of Muscat grapes are being planted this year in the State, at a low estimate. These owners have certainly the opportunity to learn from others who have made mistakes and are now correcting them. The closer the Muscat vine is pruned the easier it is to keep it in shape, as the close pruning causes buds to develop close to the stem and trunk, buds which with longer pruning would have remained entirely dormant. Some of the principal raisin growers of Fresno are this season pruning the vines back severely, in order to decrease the size of the old wood trunk. While I do not pretend to say that this is a great injury to the vine, still I cannot think but that less severe pruning would have done

less harm, and under ordinary circumstances given less opportunity for wood-decay and other infirmities of old age. At any rate, it is evident that it is easier to shape the vine by the first season's pruning than afterwards.

To Prevent Overbearing.—If Muscat vines, or any other grapevines, were allowed to carry a larger quantity of old wood, they would overbear to such an extent that the vine would soon be ruined. In all instances of overbearing, whether in fruit trees or vines, an after period of rest is necessary, which may even change to a period of disease if the bearing has greatly over-reached the capacity of the vine. In the Muscat vine especially, the overbearing is closely connected with the quality of the grape, and our object should therefore be to so regulate the pruning that the vine will bear the largest possible quantity of good grapes of a certain standard quality, which, however, cannot be generally defined. In other words, as long as the vine keeps up a high quality of grapes, we can safely experiment in increasing the quantity; while on the other hand, when the quality begins to decay it is certainly a sign that more grapes are produced than the vine can stand. What this quantity is must be considered in every individual instance, as it necessarily depends upon such circumstances as soil, location, and general thriftiness of the vine. Vines on strong soil will bear more and better grapes than vines on poor, sandy soil, and the former class can therefore be left with more spurs and buds than the latter class, which should be pruned so that the minimum yield of grapes will be reached. With vines on very poor soil we need not trouble ourselves, as the best that we can do with them is to dig them up and replace them with something else that requires less heavy ground. As regards vines on strong soil, each locality will require a system of pruning of its own, according to the facility with which the grapes set. The tendency to increase or decrease the number of spurs and buds has been and is fluctuating, and no general conclusion has been arrived at. Most growers leave their spurs too long, and the inner eyes seldom if ever develop. I am satisfied that every vine should be pruned so that even the inner eyes grow into canes, as not only do they facilitate our effort to shape and confine the vines, but they tend to keep the trunk in a healthy condition by the formation of new wood as close to the old wood as possible. As to the number of eyes to be left, I would limit them to two, including the inner eyes at the junction of the trunk and last year's bud. My reason for this is partly stated above, but it is also this: that these inner eyes, if allowed to develop from the very start of the new growth, will produce just as many and just as good grapes as the eyes further out on the canes. But if only allowed to develop later, that is, by pruning the vines after the exterior buds have begun to develop, they will not make as strong canes, nor will they bear as well, as the buds further out on the spur. From this it can be seen that I favor early pruning, as early as possible. I contend that early pruning not only favors the formation of better canes and better bunches, but that it is perfectly proper to prune any deciduous tree or plant when it is dormant. I do not wish to say that bleeding will injure the vine, but the bleeding is certainly a waste, which if preventd will cause the sap to be used for some other more profitable purpose. To cauterize the woods and stop the bleeding is probably worse than to let the sap flow out. The checking of the flow does not necessarily prevent its being formed by the roots, but, on the

contrary, the allowing of the sap to flow out will cause new sap to form. It is like cheating the roots to produce sap, making them believe that it is used for the formation of buds, green wood, and leaves. The proper way to prevent bleeding is, therefore, to prune before the sap has started; but if the vines do bleed do not stop it by any exterior application on the wounds. As to the number of spurs to be left, that will necessarily depend on the vine. Generally too many spurs are left on young vines, too few again on older vines. One of our oldest vineyardists holds it as his opinion that every cane should be left, and only shortened to two eyes; in fact, that we never can get too many spurs. But an examination of his vines satisfies me that the soil in his vineyard is not of the best, and that his vines are not as strong as they should be in order to be counted as first class vines.

Our largest raisin grower, A. B. Butler, leaves from five to eight spurs on old vines, and leaves them as close to the old wood as possible. His experience and practice, founded upon observation both at home and abroad, deserves full attention and close duty. He adheres to the idea of pruning for quality in the first place, considering quantity of less importance; to prune so that the vine will bear the best grapes, and that they may last as long as possible. I share this opinion, the more so as I have seen many sickly vines, the disease of which I must attribute to their having been improperly pruned. The nature of the vine is to climb, and I consider any pruning, of whatever kind, as originally foreign to the grape. In the wild woods the grapevines survive to good old age, hundreds of years, perhaps; at any rate, many times the age of cultivated vines. So do our famous old vines, as that in Santa Barbara, the Hampton Court vines in England, and any other vine famous for age and bearing. They all climb over trellises, and carry an enormous quantity of wood. The effect of pruning, and especially of close pruning, is then not to the benefit of the vine. I am satisfied that the diseases of the vine are especially confined to the trunks and branches, and the roots, more especially as a kind of reflex action. Mr. Butler, whom I have quoted before, holds that the trunk becomes diseased after a certain number of years, and requires to be renewed. If this is so, and I am satisfied that it is, the closer the trunk and the branches are to the ground and to the roots, the better and easier it is to renew them from below. But there are other reasons why the crown should be kept very low. Experience shows that the lower the grapes, the larger and sweeter they are. We must, therefore, in order to produce large and sweet grapes, prune short and prune low. I would rest the crown on the very ground, or only a few inches above it, but in no instance raise it a foot or more, as is so commonly seen in any one of our raisin districts. I cannot close without saying a word about the general idea that blackknot is caused by close pruning. It may be sometimes, in part, but that close pruning alone should cause it, is not by any means proven. I have this season seen vineyards which had not been pruned for two years, in which all the Muscats were dying of blackknot, which actually covered the old and new branches along their whole length. Here then, at least, the blackknot was not caused by pruning at all, but evidently by something else.

CULTURE OF SMALL FRUITS.

Essay by D. EDSON SMITH, Santa Ana.

In responding to the invitation of your Secretary to read a paper before this meeting on the "Culture of Small Fruits," I do so with the understanding that my few remarks are simply to be used as a text to draw out the knowledge of those having greater wisdom and experience on this subject.

Although the fruit treated of in this paper is small, it by no means follows that the industry is a small one in any sense of the word. It is yet in its infancy on this coast, but I believe it is destined to become a large and profitable one. There are no fruits more healthful than the strawberry, the raspberry, and the blackberry; and the last two may be used in a very great variety of ways, both as food and drink for the well and the sick. Of course, I shall treat this subject simply from the standpoint of my experience in the Santa Ana Valley.

On coming to this valley eight years ago I found the Wilson's Albany the predominating strawberry, the Cuthbert the ruling red raspberry, and the Kittatinny and Lawton the prevailing blackberries. I sent to Mr. Purdy, of Palmyra, New York, for some Doolittles, Tylers, Turners, Crimson Beauties, Hansels, and Herstines, for varieties of raspberries, and the Knox and Wilson's Early for blackberries; but I did not make a success with any of these varieties. But with the Kittatinny, Crandall's Everbearing, the Cuthbert, and the New Rochelle I have had very good success. For strawberries, I like the Monarch of the West and the Pineapple. In some parts of this section of the country the Cuthbert is the most profitable raspberry to be grown. In other localities it seems to winter kill, or live at a "poor dying rate," which is not at all satisfactory. It needs a deep, rich soil, and does much better with some kind of protection from the midday sun of summer. I plant mine in my orchard where the trees' foliage shades them.

The most profitable raspberry that I have tried is what is known as the "New Rochelle." It seems to be a cross between the Cuthbert and Doolittle. It passes for a red berry, but propagates from the tip, like a black cap. This berry is exceedingly hardy and vigorous in its growth of cane, and is a very prolific bearer. The fruit is much firmer than most of the red varieties, and will bear shipment well. Its quality is somewhat inferior, but its earliness more than compensates for this. It is the first berry in the market, and for that reason tastes exceedingly fine; still, I have a few customers who prefer this berry to the Cuthbert at any season of the year.

For family use, I would recommend the planting of a few Herstines. Most people think this variety far superior in flavor to any other kind grown in these parts. The great drawback to them is their shyness in bearing. In some parts of Los Angeles County the Scoubegan raspberry is very profitable, but I have had no personal experience with it. As a rule, the black varieties do not do well here.

Of the varieties of blackberries, I am now setting out only the Crandall. Perhaps the flavor of this berry is not so fine as some other varieties, but in all other respects I think it much superior. It is a strong, vigorous, hardy plant, very productive of fine, handsome berries; fruits over a longer season than any other variety I know of, and the

vines will not run all over your place; in fact, you will not get enough suckers or sprouts to set out a new row.

I have a row of raspberries or blackberries between my orchard tree rows, which are twenty-four feet apart. Of course I draw on more plant food, in the shape of fertilizers, than I take off.

If I was setting out a piece of ground entirely to these berries, I would have the rows from ten to twelve feet apart, and the plants four feet apart in the row. It pays to have a good rich soil for these fruits, and then have the soil put in the best condition before setting out the plants. But wait another season rather than set out your plants in soil only half prepared. Plow deeply and harrow thoroughly several times before setting out. Lastly, open a trench with your plow where the row is to be, twenty inches deep. Go along with a basket of plants, a four-foot lath and shovel, and set a plant in this trench every four feet, and pull the dirt around it with the shovel. If the trench is too deep in places for the length of the plant roots, fill in a little dirt. If not quite deep enough in places, scoop out a shovelful. Aim, in preparing the ground with plow and smoother, to leave it dishing each way towards the row of young plants, so that irrigating water turned in at the upper end will run along the row of plants as in a trough. Aim to have the ground around the set plants a few inches below the general level of the land. After the plants are all set in a row, go along with a rake, if there are but a few plants, or with a horse hoe, if there are many. It is a pleasure to set out plants in this way, and such deep, rich, well stirred soil tickles the plant roots so that they kick out their heels rapidly in every direction, and the plants throw up their heads and crow, and grow in a manner entirely satisfactory to all concerned. If the ground is dry, or there is no rain, irrigating water should be turned down the row, or at least a quart or two of water poured around each plant. Then, before the soil hardens, stir it well with cultivator and hoe, and all future care resolves itself into frequent waterings and frequent stirrings of the soil. Allow no weeds to appear, and keep the three inches of surface soil well loosened with the horse and hand hoes. These small fruits require frequent waterings, especially when forming fruit, and during the fruiting season.

When the blackberry and raspberry canes have reached a height of three feet, go along with a sharp butcher knife and clip off the tops. This will cause them to throw out laterals. When these laterals have reached a length of sixteen or eighteen inches, clip off their ends in the same way, and so with every succeeding growth of laterals. In this way you will have a strong, self-supporting tree-vine, which will be a constant source of joy to you in many ways. I keep my berries pretty heavily mulched close to the vines.

Strawberries in this country are usually grown on ridges, the space between the ridges being frequently flooded with irrigating water. The roots of this plant are so near the surface that, in this rainless region, frequent applications of water are necessary for success, during the fruiting season; and it is wonderful how so many months of the year, with our soil, climate, and irrigating facilities, we can have this delicious fruit in all its perfection. I would set out a strawberry bed this winter or spring, and in two years I would plow it up and set out another; that is, I would set out a new field every other season.

I think the strawberry guava might be well included in the list of

small fruits for this particular locality. The past unusually cold winter has proven that they will not be injured in the least by our coldest weather. They are prolific bearers of fine fruit, which readily sells for 10 cents per pound and upwards. There is no nicer, no more healthful food than fresh guavas cut up and eaten with sugar like strawberries, and they are noted as being the best jelly-making fruit we have.

They are a little difficult to propagate, and should be obtained rooted from the nurseryman. They should be set out about ten feet apart each way, and cultivated like an orange orchard. I have seen no pests of any kind on my guavas.

The scale which infests some blackberry vines can be killed with the resin wash, as follows: Resin, fifteen pounds; caustic soda, three pounds; linseed oil, three quarts; water, one hundred gallons. Boil the resin, soda, and oil in one third of the water till a perfect emulsion is formed; then add remaining two thirds of the water and spray while the solution is still quite warm.

For the sake of the healthfulness of the family, every one having an acre of ground should raise some small fruits. In my opinion, an almost exclusive diet during the summer months, of brown bread and milk and plenty of raspberries and blackberries, would very largely prevent the many troublesome and frequently fatal diseases so common among children during these months.

But all small fruits to be in the best condition must be fully ripened on the trees or vines, and for this reason are never so good as when freshly picked. Fresh berries should always be eaten the day they are picked, and those who are obliged to eat them the next day after they are picked are unfortunate. Berry picking for market should begin as soon as it is light enough in the morning to distinguish the ripe berries, and the berries got into the hands of the consumers before noon, if the market is near by, or before supper time if shipped by rail. They should not be put in packages larger than one pound, and these pound packages put in ventilated crates.

Blackberries can be profitably raised for 6 cents per pound; raspberries for 8 cents per pound. And with our facilities of soil and climate for growing these most healthful of all fruits, and with the large immigration of well-to-do people who will soon create a widespread demand in every village throughout all of our beautiful valleys for this choicest of food, the outlook for the grower of small fruits throughout all of Southern California is of the most hopeful and promising nature.

CULTURE OF THE SOFT-SHELL WALNUT.

Essay by George W. Ford, Santa Ana.

The European walnut (*Juglans regia*, Latin; *Noyer*, French; *Noce*, Italian; *Nogal*, Spanish) is one of our finest growing trees, and, after thorough test, has been found to be at home in the State of California, especially in our rich valleys, between the coast and the Coast Range Mountains.

Of this most desirable and profitable nut there are many varieties, some of late introduction from France; two varieties originating in the orchard of Joseph Sexton, Esq., at Santa Barbara, supposed to have

FORD'S IMPROVED SOFT-SHELL WALNUT.

come from seed brought from South America; and besides, the common English (or Madeira) nut, known best of all to us, as it was the first to be propagated and raised in our orchards. The soft-shell walnut (one of Mr. Sexton's varieties) is considered by all who have had experience with it to have all the points essential for a first class walnut, and on suitable land the most profitable orchard to plant.

I have in my orchard eight varieties imported from France, which, in my estimation, are entirely worthless, all being of a dwarfish nature, and, after being planted in orchard for seven years, have not as large a growth as some of my three-year old soft-shells. I first procured my seed from Mr. Sexton, and in examining them I found two varieties, a soft and a paper-shell, or rather a thin and a soft-shell.

This paper-shell, as it is termed, is a finely flavored walnut, but it is not by any means a good grower, and besides the nuts are small and the shell extremely soft, which consequently makes it difficult to ship any distance. For family use, on a small lot, and for close planting, the paper-shell will give satisfaction, and those who plant trees of this variety will certainly not go amiss.

The larger and finer variety is what I term the "Improved Soft-shell Walnut," as by selecting the nuts for planting I pick out the largest nuts, and only those that come from the largest growing trees in my orchard.

My improved soft-shell nuts took the premium at the last Downey Fair. I had about one third of a bushel there, and they averaged twenty-four to the pound. Last year a well known fruit grower at Tustin raised some soft-shells which ran as low as eighteen nuts to the pound.

I plant my walnuts in the nursery rows four feet apart by one foot apart in the row, and do not believe in planting nursery stock of any kind too close. Certainly cheaper trees can be grown by that method, but I have yet to find a stunted tree that ever gave good satisfaction when placed in an orchard.

I want one-year old walnut trees one to three feet; two-year olds, four to six feet; and three-year olds, seven to nine feet, all of the above to be good, stalky trees. The root of a three-year old walnut is but a little longer than a one-year old, though it is certainly larger. Of course, the root will grow in proportion to the top of the tree, for when a walnut commences to branch—which is about four years from the seed—then the root will commence to throw out laterals.

In planting trees in an orchard, first of all plow the ground deep, and then go over it with a harrow or pulverizer.

Forty feet apart, giving twenty-seven trees to the acre, is the best distance to plant the improved soft-shell walnut. Dig large and deep holes; plant two or three inches deeper than the trees grew in the nursery; lean them to the prevailing summer winds, and you will not have to stake your trees to make them grow straight. Press the soil firmly around the roots, and if not very moist, give each tree five or ten gallons of water, which is sufficient to settle the soil firmly around the roots. Cultivate your orchard to the depth of four or five inches. If your soil is moist enough to keep the tree in good growing condition during the summer months, irrigation is not necessary; but to make a first class walnut, in size and in the fullness of kernel, if the ground is not naturally moist enough, artificial means will have to be adopted.

I don't think small grain should be planted in a walnut or any other orchard. If corn is grown, leave eight feet on each side of your trees clear, though I am of the opinion that potatoes, peanuts, or beans are less injurious to the trees.

Pruning the walnut is but little trouble, and can be done by any one. When planting, do not cut the top off, as is done on other deciduous trees, but leave the main trunk for the center. Prune up to three or four feet (not too high), for the bark of a walnut tree is easily sunburned, so it is necessary for the foliage and lower branches to shade the trunk. If the lower limbs extend outward and are in the way of the cultivator, tie them up to the trunk, for by so doing you can train the lower branches upward, so as to cultivate close to the tree, and when the orchard comes into bearing the limbs growing upward will not bend down to the ground with the fruit, so you can't get within twenty feet of them with a cultivator.

My improved soft-shell walnut commences to bear at four years from the seed; at six years old my trees average fifty pounds of nuts to the tree, while some trees went as high as seventy-five pounds; at seven years, they averaged ninety-six pounds, and at eight years old, averaged as high as one hundred and twenty-five pounds, while some of the largest trees bore one hundred and fifty pounds of the finest walnuts I have ever seen.

I have never sold the nuts for less than 10 cents per pound, and from that to 15 cents.

Here are a few figures, which, no doubt, will be of interest to many contemplating planting walnuts:

For instance, take an eight-year old improved soft-shell walnut orchard, which will average at least one hundred pounds to the tree, at 10 cents per pound, which gives $10 to the tree, or $270 to the acre. Even at 5 cents per pound, $135 would be the gross returns, which is good interest on $1,000 per acre after all expenses for cultivating, irrigation, etc., are paid.

The above figures speak for themselves as to the paying qualities of this nut. I have a few English, or Madeira, nut trees on my place, fourteen years from the seed, receiving the same care as my eight-year old improved soft-shell orchard, but they do not bear at the present time one third the quantity of nuts that my soft-shells produce, besides obtaining a smaller market price (about 5 cents or 6 cents a pound), and the trees, though nearly twice the age, are not any larger.

It is a well known fact, not only to the fruit growers, but to our merchants, that the Madeira nut gets rancid if kept a year, though all care possible may be taken of them, but I have kept the improved soft-shell walnut in good condition for two years, while a friend of mine, Judge Bacon, at Capistrano, tells me he has kept them in first class condition for three years.

The above points are of interest to us, as, if we have the soft-shell, we don't have to crowd it off on an overstocked market.

Planting walnut trees forty feet apart only gives twenty-seven trees to the acre, and if a man is not satisfied with this small amount of trees, then let him put oranges in between (budded varieties are preferable for quick returns).

Plant an orange tree in the center of every four walnuts, which gives an equal number of walnuts and oranges; twenty-seven of each kind

to the acre. If three-year old walnuts are planted, an orchard like this will give the owner handsome returns in three years from planting if properly taken care of.

The walnut, being covered with heavy foliage in summer, protects the oranges from the cool coast winds which prevail at that season, and when the cool coast breezes have stopped blowing in the winter, then the foliage is off the walnut tree, which gives the sun full play among the fast ripening oranges. I believe an orchard like this could stand for twenty-five or thirty years without having to remove any of the trees, and am of the opinion that orange trees will produce more and better fruit if planted in this way, if near the coast, for the cool coast wind in summer is not at all beneficial to the orange.

The only good oranges I have seen grown near the coast were well protected with wind breaks, and oranges grown in this way will compare favorably with the inland fruit.

Now, gentlemen, in making the above remarks, I would say, before you plant a walnut orchard, see that you have good, rich, deep valley soil, with first class water facilities, or do not expect such promising returns as I or my neighbors in Orange County have had. I don't recommend planting a walnut orchard if you have poor soil, but something that will come off the ground early in the season.

Certainly, your land need not be anything extra, but I say that on almost any land where corn can be grown without irrigation in this State, especially in the southern part, a good quality of walnut can be raised without artificial means of watering.

In winding up this short paper on the "Culture of the Soft-shell Walnut," I will say, if any fruit or walnut grower doubts my words, I extend to him an invitation to come down to our thriving little capital of the new-born county, and I will show him there an orchard which will satisfy the most skeptical that a soft-shell walnut orchard is a paying investment.

WALNUT CULTURE.

Essay by A. Dorman, Rivera.

The soil best adapted to the growth of the English (Madeira) walnut is a deep, rich loam or sediment, where there is no hardpan to prevent the roots from running down deep, and where the water level is from twelve to fifteen feet below the surface.

The usual custom is to set two-year old trees forty feet apart, and plant corn among them as long as it will make a paying crop. This mode of culture usually includes irrigation.

I think that if the corn and irrigation were left out after the first three years, and the land given clean and thorough cultivation, it would be more profitable for the owners. Shallow cultivation is advocated by the most successful walnut growers in the valley.

The old orchards are nearly all planted too close together, and it is reasonable to expect that they will fail to produce good crops sooner than they would if they had have been given more room. Trees twenty years old often have a spread of branches fifty feet across, and I think it safe to say that the roots extend further than the limbs. I have broken roots

as large as a pipestem in plowing twenty-five feet from a tree that had been set seven years.

In setting out young trees, they should be inclined towards the coast or prevailing winds, and in trimming, always try to keep them in that position. By using these precautions and insisting on having the tap-root left at least three feet long when the trees are dug in the nursery, you will be likely to have your orchard in good shape when it is grown. No limbs should be allowed to grow within at least six feet of the ground, as they would interfere with the cultivation of the orchard.

The walnut crop shipped from Rivera in 1888 was about seventeen cars; of this amount sixteen cars were hard-shells, bringing 7 cents per pound; the other car was soft-shells, bringing 9 cents per pound.

In 1889, thirty-four cars were shipped, bringing about $45,000. Of this amount thirty-two cars were hard-shells, at 7½ cents per pound, and two cars soft-shells, at 8½ cents per pound.

The experience of the past season has had a strong tendency to increase the popularity of the hard-shell walnut among the growers in Ranchito and the Los Nietos Valley. Some of them intend to provide racks or trays of a suitable size for two men to carry, and rank them up in a building erected for the purpose where they will be safe from storms, fogs, or dews.

I believe the practice of sulphuring is injurious to the flavor of the nut, and hope it will soon be discontinued with the hard-shell as has already been done with the soft-shell.

FOREIGN WALNUTS AND THEIR CULTURE.

Essay by Felix Gillet, Nevada City.

Of all branches of horticulture so far experimented upon in California, I do not think there is one so little understood and so much under a cloud as walnut culture. This is due to several causes. Chief among them has been the undiscriminating propagation, all over the Pacific Coast for forty years, of the most delicate variety of walnuts to be found anywhere, and known here under the name of the "Los Angeles" walnut, first started in the old mission of that name. Another cause that has had the effect of retarding the progress and spread of walnut culture throughout the State has been the stand taken by eminent walnut growers of Southern California, and their erroneous statements in papers read before horticultural societies and conventions, and the false impression made by them on the public mind, that walnut culture could not successfully be carried on except in a very small section of the State bordering the sea, in the counties of Los Angeles, Ventura, and Santa Barbara, and where to this day most of the walnut crop is grown. Now, there is as much truth in that as there is in the idea entertained by many people in Southern California, that no oranges can be grown profitably for market north of San Bernardino County. Indeed, some of the best oranges I ever ate came from Smartsville, in the foothills of Yuba County, a few miles from Marysville, and right in the heart of Northern California.

In discussing the adaptability of our State to the successful growing of this or that class of fruit or nuts, we should always bear in mind the

great diversity of soil and climate to be found in a State like California, extending, as it does, from the burning deserts of Arizona to the snowy peaks of Siskiyou, and that in nine tenths of this vast extent of country the walnut is liable to be injured by late frosts in the spring; hence, the advisability of planting none but hardy kinds.

The idea that walnut culture in California is possible only in those little valleys bordering the sea in Southern California, is, I must say, a preposterous and erroneous one. "The area of land suitable for successful walnut growing is very limited," said a well known nut grower in an essay on the English (Madeira) walnut, before a former Fruit Growers' Convention. "It requires well drained, deep, sandy, *bottom* land, well protected, and where no 'live oak' trees have grown within the last century." Now, I do strongly object, in the presence of facts to the contrary, to the above banishing of walnut culture from nine tenths of the area of the State of California; and I do not care, either, what Pliny said two thousand years ago on that subject, but will cite an instance in the course of this essay that will set at naught the theory that walnuts will not do well "where an oak forest has recently existed." That walnuts will grow more luxuriantly and bear larger crops at comparatively earlier age in deep and rich bottom land, well drained, well protected, and with plenty of moisture, is an obvious fact; though there arises another question: whether it is advisable to plant walnuts—a class of trees requiring so much space and with so little regard to the nature of the soil—in our richest land, so well adapted to the growing of other valuable crops that have *absolutely* to be raised in *rich land*. My experience in walnut culture, and for twenty years I have imported, propagated, and fruited all the leading varieties of Europe, besides having collected a large amount of data on that subject from nut-growing countries, warrants me to say that walnut culture can be successfully carried on on the whole Pacific Coast, provided we plant none but *hardy* kinds; in fact, the success of walnut culture in California lies exclusively in the hardiness of the kinds to be planted.

The Los Angeles (English) walnut, which, by the way, has been constantly propagated from the seed for the last forty years, without any regard to the degeneration of the species, has three big defects that should make every one reject this variety as worthless, except where it is known to do well. First, it puts forth too early, from two to eight weeks before the foreign kinds, and is injured by late frosts in the spring three years out of four; second, it does not mature its wood well in the fall, and is nipped again by early frosts at that time; third, it blooms very irregularly, as the owners of such trees all over the State can very well ascertain in the spring at blooming time, the male flowers, or catkins, all dropping off before the female flowers, or nuts, had a chance to show themselves; consequently, the nuts, not being fertilized by the pollen or yellow dust secreted by the catkins, drop off after attaining the size of a large pea. In this way does that variety keep barren, or at least so unproductive that it has already induced many people throughout this State and Oregon to cut down their trees, some of them over thirty years old, they having come to the conclusion that the country was not adapted to the walnut, while it is that worthless kind, the Los Angeles (English) walnut, that is not adapted to our climate and that of Oregon.

Here is a good illustration of the case under discussion. A short distance from this town is a large Los Angeles walnut tree, measuring two

and one half feet in diameter at the base, having been planted when four years old in 1860. That tree yielded in twenty-one years seventeen nuts—eleven in one year. In 1881 it was grafted into a Præparturiens, and in 1884 bore for a start four hundred to five hundred nuts, and last year, though the hailstorm on the twenty-seventh of April did considerable damage to the nuts then partly out in bloom, five bushels of nuts were gathered from that tree, and lots were carried away to the woods by bluejays, birds very fond of acorns and soft-shell nuts of all kinds. This very tree stands seventy-five feet below a huge oak tree, which has been permitted to stand there on the right hand side of the entrance gate on account of its beauty. That oak tree measures four feet in diameter, with a top from sixty to seventy feet in height; though its branches do not meet those of the walnut, it towers up above the latter. In the vicinity and on the hillsides are many other oak trees, but much smaller, and that grew back after the cutting down of large oaks years ago. Well, this close proximity to oaks does not seem to hinder in the least the growth, development, and bearing qualities of the walnut, as should be the case if there was anything true in the assertion, that "walnuts would not do well where an oak forest had recently existed."

The irregularity of bloom of the Los Angeles walnut, and its consequent unreliability as a bearer, also its tenderness, first drew my attention to walnut culture in California and induced me to introduce into this country the best and most hardy foreign kinds known. In that way did I experiment these last twenty years on the following foreign varieties: Præparturiens, Cluster, Mayette, Franguette, Parisienne, Grenoble, Serstina, Chaberte, Gant, Mesange, or Paper-shell, Vourey, Meylan, Culong, and also fancy kinds like Weeping walnut, Ash-leaved walnut, Mammoth walnut, and others.

Those foreign varieties differ widely from each other, all having special characteristics; some being recommended either for the extraordinary size and fine shape of the nuts, or for their surprising fertility and precocity; others for their lateness in budding, which enables them to withstand, uninjured, late frosts, so common in the spring, that hardly one tenth of the whole area of this State may be said to be exempt from them. A question, however, has been often asked, Which among this large collection of foreign walnuts may be considered the best to plant for family use, and which the best for market? A question of much import, so that no mistake should possibly be made.

As the size, shape, even color of the shell, is not precisely an object whenever a walnut tree is planted in the family garden, but rather the quality of the kernel, thinness of the shell, precocity and fertility of the kind, no variety recommends itself better for the family garden than the Præparturiens, or Fertile walnut. Surely, there are varieties more late in budding out, such as Mayette, Vourey, Parisienne, and Franguette, that might be preferred wherever late frosts in the spring are the rule; but, on the average, the Præparturiens will do in almost all parts of California as the walnut *par excellence* for the family garden. The Præparturiens is not precisely a large walnut, though "second generation" trees bear nuts of a fair size, some of them quite large, but it is so fertile and bears such good crops from the very start, and when quite young, that it is very valuable. I have found the Præparturiens to give good crops where the Los Angeles walnut was barren, in Dutch Flat, high up in the Sierra, in the foothills of Butte County, in Marin

County, close to the sea, in Stockton, in Nevada, two thousand six hundred and two thousand eight hundred feet in the mountains, and in many other places.

Now, as to what varieties of walnuts to plant for market: It is a fact that the best marketable walnuts are those that are the largest, fairly shaped, thin shell (not paper-shell, a kind that should never be planted for market), light colored, and with a fine, fat, sweet kernel. This is independent of other characteristics, such as fertility, hardiness, and lateness in budding out. Whenever a variety combines all the above characteristics, it might very well be called the "boss" variety to plant for market.

For size and beauty of the nuts, I find that no varieties can surpass the Mayette, Parisienne, and Franguette, which I have fruited in California. But size and beauty of the nuts are not the only advantages of these three fine kinds over all others, for they are, besides, hardy, putting forth late, and seldom, if ever, injured by frost in the spring. (They never were on my place at an altitude of two thousand six hundred feet.) As to the kernel of these three kinds, it is very fine, corresponding fully to the size of the shell, with a sweet and nutty flavor.

As to their fertility in California, I cannot tell much yet, for my bearing trees are rather young; but the way they bear is encouraging. The Præparturiens, Chaberte, Vourey, Cluster, and others, have more or less claims as nuts for market.

Walnut growing is an industry that ranks very high in France, and which can be developed on the same scale in a State like California, if only we are wise enough to study the French method a little and do as they do, planting none but *hardy* kinds, and planting them on plateaux, hillsides, rolling land, alongside roadways, around large fields and vineyards, in cordons and avenues, on soils not well adapted to other crops, and where the walnut in the course of time will grow to gigantic dimensions. But keep your deep and rich bottom land for the growing of other crops, and remember that walnuts require much space, and that in rich and valuable land walnut growing might, after all, prove unprofitable, if you take into consideration the extra value of the land.

The walnut belt in France comprises two thirds of the whole area of that country, extending from the ocean to the Alps and Jura Mountains, and from the Pyrenees Mountains to the Loire, a belt where exists a similar diversity of soil and climate as is found in California from one end of the State to the other, and up to two thousand five hundred to three thousand feet in the Sierras. The finest walnuts in that immense belt come from the Department of Isere in the southeast, and are exclusively grown on grafted trees; the kinds most generally propagated, on account of their hardiness and beauty of the nuts, are the Mayette, Franguette, and Parisienne; the latter is found to do better in light soil, while the Mayette and Franguette prefer a rocky soil, but rather deep and rich. The Chaberte, less particular as to the nature of the soil, but very rich in oil, is much grown for the oil mills. To give an idea of the extent of the walnut industry in France, I will say that the Department of Isere alone exports annually to the capital of Russia, $100,000 worth of Mayette walnuts. Most of the walnut crop of that and adjoining Departments is carried down the River Rhone to Marseilles on pine log rafts, at which port nuts and lumber are better delivered for market. The walnuts of the Isere bring the best price of any walnuts in France—5 to 8 cents per

pound, according to years—in fact, Isere walnuts sell with a premium, which is another illustration of that truth, that fine fruit will always bring better prices anywhere. In that part of France the walnuts are planted a little everywhere, especially on rolling land and hillsides. By the way, whenever having level or rolling land on your place, always plant the walnuts on rolling land. In the Department of Dordogne, from which comes the bulk of the walnuts exported to the United States from France, statistics show six hundred thousand walnut trees. The walnut crop of that Department, in nuts for market and oil, amounts annually to $1,000,000. The nuts are exported to the north of France, Switzerland, and the United States. To the latter country, on account of the tariff, are exported only the common kinds. In the Department of the Loire, fifteen thousand acres are planted in walnuts, the trees being planted as high as two thousand three hundred feet in the mountains; and so on in the whole walnut district.

Walnut picking costs 5 cents a bushel in France, and prices for walnuts vary from half a cent to 8 cents per pound. The cheap nuts are sold to the oil mills, the finer ones shipped to market. Paris alone consumes fifteen million pounds of dried walnuts and ten millions of fresh nuts. Half of the oil used in France is walnut oil, or three times as much as olive oil. One hundred pounds of walnuts average eighteen pounds of oil.

My advice in regard to those foreign varieties of walnuts is that where the Los Angeles, or common walnut of California, does badly, people should not hesitate a moment to plant them, as being so much superior and more hardy; and where that same Los Angeles walnut does well, to give at least those foreign kinds a fair trial, and see if they would not prove more profitable than the common kind. It is as easy to grow fine nuts as poor ones, and certainly more profitable.

As to the "culture" of those foreign kinds, since they are but mere varieties of the Juglans regia, or common European walnut, or English walnut, so called by the colonists of Virginia when that tree was first imported to America from England, and to distinguish it from our native black walnut; and as Mr. A. Dorman, of Rivera, and Mr. G. W. Ford, of Santa Ana, have papers on "Walnut Culture," and not desiring to take up any more of the time of the Convention, I will say nothing more, trusting that these gentlemen will ably and fully dispose of that subject.

DISCUSSION.

Mr. J. Hobart, of Nordhoff: I would say, if you would visit Ventura, there are, in the center of the town, quite a number of walnut trees grafted on the native walnut. They are twelve and fifteen feet high. I live eighteen miles back in the Ojai Valley, where there are a great many native walnuts, and I have one tree which I grafted onto the native walnut, and it is growing very well. What Felix Gillett, of Nevada City, says in regard to the growing of the walnuts in our valley is correct. He could not have described it better if he had visited our place. I claim, if you get the right variety where they fertilized, we can raise them. I see no reason why the English walnut should not grow in that section where the native walnut abounds and flourishes; but as to grafting these

trees, it can be seen in Ventura. They are large trees, and, I presume, were grafted twelve or fifteen years ago.

Mr. Buck: Mr. Lelong has told me that he had grafted the English walnut onto the wild black walnut. I cannot give you any definite instances, although I know of a few cases in which they are growing nicely, but they are not old enough to bear.

Mr. Kinney: I saw them only three years ago. I was surprised at the size of the tree, but it established the fact that they would grow on this root, and I don't see any reason why not. There is a great deal of difference in the formation of the valley, where the experiment was made—La Puente. The south of the mountain side, where I live, carries the oak to the top of the mountain; on the other side, nothing—perfectly bare. There is a great deal of difference in the soil. The wild walnut is limited to the south of the mountain side, or the south side of the valley, where the soil is very deep and rich.

Mr. Dorman, of Rivera: We claim our crop of walnuts is fairly profitable; from some individual trees over three hundred pounds are returned. Last year we got 7½ cents per pound. Take trees set about forty feet apart—twenty-seven to an acre—it would make a fair return, but nothing equal to oranges; because, in that same neighborhood we have orange orchards that have given a return of considerably over $600 per acre; not every year, but occasionally.

Mr. Paine: As to the bearing of walnuts in San Bernardino County on the mesa lands, even where they are well irrigated, the crop of English walnuts is only about one third as much as it is in the bottom or naturally moist lands of the country, while the trees on those mesa lands will grow to as large size as they do in the low land.

Mr. Kellom: I don't think Mr. Ford wanted to be understood that the soft-shell would become rancid while the other would not. I didn't so understand. We have no rancid walnuts down there, unless they become so by extreme sulphuring and not drying. Colonel Heath, of Santa Barbara, is authority on the walnut, and he has a dry range where he dries his walnuts, and he does not sulphur them. In Tustin we have a very old walnut orchard, and some of the trees in that orchard have yielded from $27 to $30 a year in fruit. Those trees are about eighteen years old. In the oldest settlements of San Bernardino and Los Angeles Counties the Mormons planted the walnut trees. They were probably Englishmen from the southern part of England, and they brought the walnuts with them and planted them. There was no system of irrigation, and of course there was neglect in their culture. The probability is this story has got out from that, that the walnut tree does not require one fourth of the amount of irrigation that the orange tree does. I think it is a great mistake, for I have noticed that where walnut trees happen to be set along our irrigation ditches they produce walnuts, and of fairer size and more of them. So that we have come to the opinion that it pays to irrigate the walnut trees, and we regard the walnut crop in our county (Orange) next in value to the orange crop. At San Juan, twenty-two miles below Santa Ana, it did me good years ago to see the wagons piled to the top with those great sacks of walnuts—hay stacks, as it were—with four and six-horse teams. And they all come from an orchard planted years ago, and within half a mile of the ocean.

Mr. O. N. Caldwell, of Carpenteria: We do not irrigate the walnut

where we live. I live adjoining Mr. Heath. He is quoted as authority upon the walnut. He does not irrigate. He has a great many trees; nearly two hundred acres, I judge. Some places it is thirty feet to water on his ranch, some seventy-five before you will find water, and in other places not more than fifteen feet, according to the formation. The nearer the creek we get in many places, the further we have to go to water, because it is rocky. For our annual rainfall we want twenty inches, but we oftentimes don't get it. We had thirty this season, and a little more. We have some fogs there, and they are not only beneficial to our walnuts, but help us out on the bean question. Beans are very profitable there on proper ground. Mr. Gillett says the walnut will grow on any soil where good corn will grow. The English walnut will not do it, according to my experience. I have mesa land which will raise good grain of almost any kind, and will raise almost anything, but it will not raise Los Angeles English walnuts. If the French varieties will grow on our mesa land, we will have a fine thing of it.

MR. THOMAS: H. K. Snow, of Tustin, says that four years ago he put away some soft-shell walnuts, and this winter they tried them, and none of them were at all rancid. Coming from the source it did, I was very much surprised, because I know that the old English walnuts here do become rancid after the first year.

MR. HIGGINS: Mr. Thorpe, of Ventura County, told me that he had seen two rows of English walnuts and native wild walnut grafted on English walnut. He told me the native wild walnut grafted bore fully twice as many nuts.

Recess until 2 o'clock P. M.

AFTERNOON SESSION.

FRIDAY, March 14th, 2 o'clock P. M.

(President COOPER in the chair.)

REPORTS FROM COMMITTEES.

JUDGE AIKEN: Having served on the Committee on the Monument of Matthew Cooke, Mr. Johnson, the President, who resides at Sacramento, and not having attended our meetings lately, I do not know what he has done. I can hardly report progress, and at the next meeting of the Convention we will endeavor to present a report.

MR. BLOCK: I move that the committee be given further time, and that the Secretary be instructed to notify the Chairman of the committee to do something in the matter.

Seconded and carried.

The report of the Committee on Railroad Freights being called for, Judge Aiken, the Chairman of the committee, said: I will report progress, and that we have not been able to ascertain exactly from the railroad authorities the rates that will be charged the coming year. However, the committee will continue its efforts, and be able to report at its next meeting. Very little can be done in this way until about

the first of April, when we will probably reach the railroad authorities and use the best endeavors to obtain better rates for the coming year.

THE PRESIDENT: I would state to those members who heard the suggestion for the appointment of a committee to memoralize Congress for an appropriation to send an entomologist to Australia and adjacent islands to look for parasitic insects, that there has been no action taken on that proposition. If it is the desire of the Convention to take such action, it will be necessary to have a committee appointed to draft the memorial.

JUDGE AIKEN: That is a very important step. I would move that a committee of three be appointed to report later in the session to-day a memorial to Congress.

Seconded and carried.

The regular programme for the afternoon was here taken up.

THE MYSTERIOUS VINE DISEASE.

Essay by N. B. PIERCE, Washington.

On November 8, 1884, we find recorded in the Anaheim "Gazette," under the head of "A New Winery," the following: "The large increase in the production of grapes this year, caused by the fact that hundreds of acres of new vineyards contributed their first crop, taxed the wineries beyond their capacity. They were unable to work up the grapes as fast as offered, and as a consequence the growers, especially those whose first experience it was, grumbled deeply and loud, and prated of overproduction."

On January 17, 1885, the same journal says: "The vineyard area will be largely extended in the vicinity of Anaheim this year."

This, then, is the apparent prosperity of the grape industry at Anaheim during the close of the season of 1884. But later developments clearly show that an unsuspected force was even then at work undermining this profitable industry.

In the summer of 1884, a few vines of the Mission variety, in one of the vineyards situated in the southwestern portion of Anaheim, became unhealthy. In the spring of 1885, in each of several contiguous vineyards in the same portion of the town, a few vines failed to produce a healthy growth, several vines not starting at all. But the following, from the "Gazette" of April 4, 1885, will clearly show that no serious trouble was then suspected; it says: "Many vineyards are far enough advanced to give an idea as to the probable crop, and those who know are of the opinion that the crop will be a very large one, barring accidents. The vines are showing up wonderfully well under the stimulating and warm weather." On the eighteenth of the same month we find the following: "A rare instance of vinous fecundity is the Burger vineyard of J. J. Dryer, which at three years from planting yielded close on to three tons to the acre." April 25, 1885, we find: "The grape crop here is likely to be very fair. Such are the present indications."

As the summer of 1885 advanced, the old Mission vines in the southwestern portion of Anaheim, in that region where some had failed to produce growth in the spring, quite generally showed a yellowish cast of the foliage; and as the heat of the season came on this appearance

extended to most of the Mission vineyards of Anaheim and vicinity. Still the people at large did not fully comprehend the situation. The crop of Mission grapes from the older vineyards was noticeably deficient; but owing to the young vineyards, just coming into bearing, the total yield for the season was quite satisfactory. At this time the Muscat vines were still in full bearing in all parts of the Santa Ana Valley. The "Gazette," of October 10, 1885, says: "Many paragraphs have been printed this season regarding heavy yields of grapes, but we are gratified to be able to cap the climax by recording the phenomenal yield of the Muscat vineyard of Mr. John J. Duff, situated about one mile north of town. This vineyard yielded twelve tons to the acre, and there is about a ton to the acre, second crop, left on the vines. Two vines gave three trays of grapes, each weighing seventy pounds, making the yield of each vine one hundred and five pounds." This record could probably have been equaled or surpassed in other vineyards of the valley at that time. McPherson Bros., of McPherson, who were making raisins in the foothills, it is also recorded, "have already covered one hundred and sixty acres of land (with drying grapes), and are still enlarging their yard."

It became generally remarked, about the heat of this season, that something was wrong with the old Mission vines; and for the purpose of briefly following the early history of this trouble, we quote again from the same journal, of October 24, 1885: "The sound of the crusher is yet heard in the land, but very faintly. The vintage is in its last stages. It has been much more satisfactory than was anticipated, though it must be confessed that while some growers have cause for satisfaction, others cannot greatly felicitate themselves. Although this was an off year for Mission grapes, there are many instances of large yields."

In the fall of 1885, we then have nearly all the old Mission vineyards of Anaheim and vicinity showing a decidedly lowered vitality. In the spring of 1886, after the winter months of rest, the vines again put forth, and we have, on March 20, 1886, the following record: "The vineyards of Anaheim are putting forth leaves. In the warmer soils the vines show an unusual forwardness. The season thus far has been favorable for planting new vineyards and for the growth of the old vines. But little, if any, irrigation has been required. The outlook is auspicious." But this condition of things was not general, and large numbers of the old vines have failed to produce more than a short growth, and many even failed to start. By July this vine trouble had become serious, and we find the people of Anaheim becoming anxious. On July 24, 1886, a meeting of vine growers was called and a discussion held, the result of which was the appointment of a committee to set on foot an investigation into the nature of the trouble.

From this time forward the destruction of the Mission vines was rapid and relentless. The crop of 1886 in the old Mission vineyards was not more than 10 per cent of the usual crop; while the loss in 1885 had probably not averaged more than 30 per cent in these vineyards. The grapes dried on the vines; the canes died back from the ends; and when the pruning season came it was found that but a small amount of vitality remained in a great majority of these vines. The pruner could tell a diseased vine as soon as his instrument entered the wood. It may be fairly claimed that these great, and for more than twenty years most productive, vineyards were dead or worthless at the close of

the year 1886. This was not all. The foreign varieties, most numerous on the south side of the Santa Ana River, where the great Muscat vineyards stretched along the foothills as far as the eye could reach, were also beginning to show spotted leaves, poorly ripened canes, and other signs of a reduced vitality. It is true that the output of grapes and raisins for that season was large in the valley; but those of an observing habit could see that the vines were not in perfect health. At the close of 1886 the trouble was beginning to show itself in many places miles distant from the point of first appearance.

In 1887 there was a failure of a great percentage of the Muscat vineyards of the Santa Ana Valley, especially those located in the higher, drier, and consequently warmer situations. Many of the vineyards located in the river bottom, where the soil was a rich sedimentary deposit, or of a sandy and cooler nature, were still preserved and bore good crops. It was in the summer of 1887, after the death of thousands of acres of vines in the Santa Ana Valley, that the same trouble was seen to crop out in distant vineyards; many old vines, especially of the Mission variety, becoming badly diseased or dying in San Bernardino and Los Angeles Counties. From that time to the present, vineyard after vineyard has been giving up to this scourge, usually at greater and greater distances from the point where the first deadly effects appeared. Although vines of certain ages and varieties, or in certain sandy, cool, low, or favorable soils, still hold out in the midst of the dying vineyards of older, less resistant, or less favorably located vines, yet it is evident to one who has worked over the entire field, that the trouble has extended out progressively, year by year, since 1884, from a common center. This work is still going on. It must be understood that local or special conditions are not here considered. In speaking of the general spread or more distant development of this trouble, we intend investigating it, but only where other conditions are equal. There are vines within a few miles of Anaheim that have yielded abundantly up to the past summer, but this has been due to special conditions of temperature, moisture, soil, variety, age, etc., and which conditions cannot easily be explained except after a most thorough and general canvass and study of the infected district.

Of all the vine affections known to science, we have here one which, in the deadliness of its nature, the universality of its attack in a vineyard, and the obscurity of its workings, is nowhere surpassed. In a vineyard showing this trouble more or less generally, it may be said that every vine will die from its effects. There are in the longest affected districts few exceptions to this rule. This feature of the trouble is one which should not be lost sight of in our search for cause and cure. It is in fact *the* feature of this affection; every vine thus attacked dies from the effects, be it sooner or later; and, so far as the longest affected district has shown, no vine in the affected vineyards will remain for any great length of time exempt from the trouble. As a certain writer on this disease has said, "The salient facts are the important ones to be first considered." Of all the features forcing themselves upon us, those of virulence of nature and eventual completeness of attack in the vineyards affected, are the most prominent. One other related feature, but perhaps of equal importance, is that of the almost or quite universal death of vines started from cuttings taken from diseased stock; thus pointing, with much force, to the disease as

being inherent in every portion of the infected vine. A cane may be well ripened and stored with starch, yet produce a vine early showing signs of disease, and soon dying. Vines weakened through the action of downy mildew (*Peronospora viticola*) will furnish cuttings of an unhealthy nature. A considerable percentage of cuttings from such vines will fail to start, or will soon die; but when they have once formed sufficient foliage and root to carry them the first season, the number that will die the second season is immaterial. With the present trouble this will not hold good. Many cuttings fail to start; others make but a short growth; while those continuing to grow through the season will mostly die the second year.

After several months of thorough and careful field work, extending over most of Southern California, we have brought together many facts of importance and interest bearing on the effects, distribution, and nature of this trouble; but which, of necessity, can only be presented in a full report to the Department at Washington. The following facts, however, have been clearly established. The death of the vine is not due to any of the commonly known parasites of Europe or America, such as phylloxera, downy mildew (*Peronospora viticola*), anthracnose (*Sphaceloma ampelinum*), powdery mildew (*Uncinula ampelopsidis*, or *Oidium Tuckeri*), to any of the rots, or to any of the well known root fungi, as *Dematophora necatrix* or *Agaricus mellius*. It is also true that it is not due to pruning, to cultivation, to irrigation, or to want of irrigation; to too dry soils, or to too wet soils, when considered as normal conditions; to too poor soils or to too rich soils, or to the want of any required constituent of the soil; to the effects or to the want of sulphur; to the prevailing winds, to what are locally known as "northern" or "Santa Ana" winds. This last statement will appear well founded, when it is known that vineyards lying miles outside of the course of these winds have died, while in other regions, in the direct track of the most severe of these winds, the Mission vine has prospered for thirty years or more.

We are then led to exclude all the better known causes of vine disease, and to classify our trouble with that considerable group of illy defined affections, which in Europe have been the occasion of much investigation, with often quite diverse results, or to consider that we have an affection of the vine wholly new to science. Although the latter is by no means impossible, it would be hasty to consider it probable till a thorough canvass of known affections had been made.

What of the possible relationship of this trouble as indicated by its observed characteristics? There are a few matters that stand out clearly defined in this connection. There has never before been in California such a complete, such a widespread, or such a continuous death of vines. The vine in California which dies first with this trouble is the Mission vine. The Mission vine has been successfully grown in this same region for from thirty to one hundred years. I think it may then be fairly said that we have a new or exceptional case in hand. If we have an exceptional case, to what date shall we look for the inauguration of these exceptional conditions? This, we feel confident, can be placed during or about the year 1884, as already indicated. From that time on the death of the vines has been steady, progressive, relentless, and complete.

In Europe there are several long known but illy defined or poorly understood affections of the vine, which result in its death. One of

these is known as folletage, or apoplexy; while another, long known in Sicily and throughout Italy, is designated as *mal nero*. It is to these two affections that our trouble bears most points of resemblance. It is unfortunate that the nature of both of these troubles is quite imperfectly understood.

Folletage, or apoplexy, has been considered as a physiological accident, which occasionally occurs to scattering vines in a vineyard, and which it is claimed almost invariably results in the death of the vine. Professor Viala tells us that "there is sometimes observed during the period of full vegetation, particularly in July or August, some vines in the midst of a plantation that suddenly die. The leaves fade, become stained and dry; the branches and even the stem suffer the same way; in a few minutes the vines may die." Viala states that this trouble "never manifests itself over a continuous surface." He also says that "folletage is produced in all mediums, but most frequently in deep soils, cold or humid; as in wet, sandy soils, or rich alluvial, on the borders of rivers. It is after great rains, and during great heats, when hot winds blow in damp years that it is to be feared. In Algeria the sirocco sometimes causes a quick and entire desiccation of the exterior organs." The general claim of European writers on this affection is, that it is rarely known to affect more than a few vines in a vineyard; that the death of the vine ensues—often immediately; and that the vine rarely sends forth new growth when cut back. There are some features here, as well as in the appearance of the foliage, which remind us of our disorder. The leaves of vines affected by folletage are often stripped much as in the present case; the vines remaining green. However, our affection disagrees with the diagnoses of folletage given by Europeans in the following not unimportant features: The California affection rarely produces sudden and complete death of the vine. Many vines live two, three, four, five, or even more years before they die, making their death often very gradual from the time when the affection is first noticed in the vineyard. The trouble, unlike folletage, spreads over a continuous surface, eventually taking every vine in the vineyard, and every vineyard in the region. Again, our affection is seemingly progressive; it kills the same variety of vine in like soils in later and later years, as we pass to greater and greater distances from the point where like vines first died. I feel that at present we can hardly be justified in saying that the effects of a case of sunstroke (folletage), occurring in the season of 1884, could still be cropping out and killing vineyards which have borne as high as twelve tons of Muscat grapes to the acre as late as the season of 1888, and which last season dropped to six tons, and began to show disease. The case I refer to is near Florence. On the other hand, if we assume that there is now a constantly recurring series of sunstrokes, we are looked to to explain why these special conditions had not destroyed the most susceptible Mission vine during its century of growth at San Gabriel, its quarter century at Anaheim, and its four score years at Los Angeles.

Although we find many difficult points to explain under the view that our trouble is identical with folletage—or what is really sunstroke—it should still be borne in mind that the season of 1884 was in some respects an exceptional one. The rainfall of that year was nearly three times as great as the usual rainfall of Southern California.

The second affection of vines, with which it is well to compare our

disease, is *mal nero*—a disease which has worked great destruction in the vineyards of Sicily, throughout Italy, and in adjoining regions.

A large number of Italian students have devoted themselves at various times to the elucidation of the characteristics, nature, and workings of *mal nero*. It is not best to enter here into any extended review of the literature of this malady, but a few extracts are required to properly place before us the more or less generally accepted views respecting the nature of this disease. It is quite generally agreed that *mal nero* is of ancient origin, but the attention of scientists has been especially called to it within the last twenty years. It has existed since 1868–9 in Sicily, where it raged in 1877, ravaging a large section of country. It is stated that it "exists in a black-brown putrefaction of the wood, and exhibits itself on the outside by brown spots on the branches, the buds, and the petiole of the leaves, and also on the footstalk of the cluster, which dries up and leaves only a few healthy berries. The buds are weak, the leaves shriveled and withered, with parched and burnt-looking patches on the outer edge. The diseased vines die after a period of from three to five years." Dr. Gregori says: "The spring buds in the infected vines appear pale and feeble, then yellowish spots appear on the leaves, other spots of a black color succeed each other upon the branches, followed by a withering, mortification, and laceration of the tissues." We find it recorded that, "The disease manifests itself first upon the upper part of the plant, and descends little by little, encroaching by degrees on the underground part, which dies; but it does not attack the roots until from three to five years." It is also said that, "By a kind of compensation for the ravages caused by the disease, the plant puts forth many very vigorous shoots from the main body of the vine, near the ground, or even from the roots. We must not, however, deceive ourselves; these shoots will also become infected and die the following year." I regret to say that up to the present time I have been unable to obtain any careful records of the behavior of cuttings taken from vines infected by *mal nero;* but from the preceding statement, that healthy shoots will take the disease by transmission from diseased roots, I think it not unfair to suppose that cuttings would inherit the disease with *mal nero*, as seemingly they do with our own affection.

Professor Comes, who has probably given more study to this disease than any other European scientist, assigns it the following characteristics: "Palor, shriveling, mutilation, and dryness of the leaves; dryness and blackening of the branches and stalks; dropping of the fruit, unequal and interrupted growth of the berries in the same bunch; blackening and decortication of the bark of the branches and stub; drooping, partial blackening descending from the upper part of the plant; afterwards the putting forth of shoots, more or less vigorous, from the foot of the stem. At last, after a longer or shorter period (from three to five years), weakness, enfeebled vegetation, great wasting and death of the plant takes place, slowly during the winter, suddenly during the summer."

An anatomical study of vines diseased by *mal nero* has led to about the following diagnosis:

Mori states that in transverse sections of the cane there are seen "little clots of gum, which are produced especially in the lumen of the vessels," and he thinks that "this emission of gum is the cause of the pathological condition of the plant."

Others have attributed the trouble to "a vicious function of the organs of nutrition and an imperfect performance of the physiological function." It is claimed by Garovaglio and Cataneo that "in infected plants, many of the vessels, especially the rays, are found to be filled with a substance that obstructs the inner cavity after the manner of a bung;" and that the bladder-like vesicles, so commonly seen in the vessels, are "filled within and covered without with thousands upon thousands of 'bacteria.'" These scientists claim that "it is precisely in this alteration of the juices contained in the organic elements of the wood that we must look for the cause of the disease, which undoubtedly arises from a faulty assimilation."

Garovaglio also states that "the wood of the stem is spotted with hazel brown as far as the root, and clusters of bacteria are found in the vessels." Sommer tells us that in the south of France a similar disease has been known for ten years; that it acts upon the pith and wood of the entire vine as far as the root, killing the plant. It is known by the yellow color of the leaves in spring, as well as by the blackness of the wood, and, that "by the continued injury done the plant, it perishes." The views of various scientists, although not harmonizing in all features of this disease, are very similar as to one fact of observation, viz.: the presence of a substance in an abnormal condition, filling many of the cells of the wood and bark of the diseased vines. The nature of this substance has been in question for many years, but perhaps the balance of the evidence rests with those who consider it of a gummy nature. It is claimed that much of this amorphous deposit within the lumen of the cells is due to an abnormal degeneration of the cell contents—mainly starch. It is also held that this degeneration is caused by an active ferment within the cells themselves. Views as to the nature of this ferment vary, some holding that it is due to the presence of micro-organisms (bacteria), which are seen in immense numbers within the altered substance and throughout the vine; others affirm that it is a zymotic ferment of the diastasis class. It may at least be said that the mass of evidence points to a pathologic condition of the sap of the vines affected, the abnormal degeneration of the cell contents and the infection of healthy shoots springing from below the ground being a portion of the evidence advanced.

Professor Targinoni-Tozzetti has kindly furnished me with material affected by *mal nero*, of which a partial study has already been made.

After having given the preceding review of folletage and *mal nero*, the two European affections of the vine with which our disease can, with the most reason, be compared, I think that the California disease appears to be more nearly related to *mal nero* than to folletage. Of our disease and *mal nero* we may give the following characteristics: They die back from the top, and the canes turn black; the green bark of the diseased cane is usually covered, more or less thickly, with minute, often protuberant, pustules of gum which fill the cells at these points; the leaves turn yellow or red in spots, and dry up about the edge; there are seen minute drops of gum upon the yellow spots on the leaves; the vines do not die suddenly, but survive for from two to five years or more; they send out healthy "suckers," which become infected and die the following season. The characteristics of the anatomical elements are closely related. There is good reason to think that the sap of vines affected by either disease has assumed a pathologic or zymotic condition, the cut-

tings inheriting the disorder (?). These diseases are not confined to a few vines in a vineyard, but affect every vine, extending over a continuous surface. They are both progressive and capable of denuding an entire region. Neither, so far as an investigation has extended, presents any obvious cause for the trouble in the form of higher fungi; and at the present time most Italian workers have discarded the idea that parasitic fungi bear any casual relation to their disease. After asking the pardon of our scientific friends, perhaps we may be allowed the liberty of using a negative character, by saying that we almost feel that the absence of any apparent cause in these two diseases indicates a generic, if not a specific, relationship.

I will now briefly indicate some of the lines of study thus far pursued in our investigations of the California disease.

During, perhaps, two thirds of the time since my arrival in the State, I have occupied myself with active field work. This is always an essential feature in arriving at true results. One of the most faulty features of the work of nearly or quite all the European students of *mal nero* has been the want of facts gathered personally in the field. For instance, they leave us almost entirely in the dark as to whether vines will again grow successfully in a region once denuded by *mal nero*.

During the field work the matters of the origin, spread, distribution, and workings of the disease in various regions were among the leading features of study; but much of the field work has been upon the effect of the disease seen in the individual vine. Much attention has been paid to the growth of cuttings, presumably healthy, brought from various sections of the State and from the East. The result has been to show that the trouble has not yet passed away, but continues to infect vineyards set from cuttings and rooted vines, and some seedlings have died apparently from the same cause. The host of observations made and of theories considered cannot here be touched upon.

The laboratory portion of the work has included a thorough microscopical study of the affected vines, including the foliage, canes, body, and roots of the same. During this examination numerous fungi have been observed and given the study they appeared to require. Up to date I cannot say that any forms have been found upon the upper portions of the vine which it appeared possible could bear any casual relation to this disease. I find, however, some two or three forms upon the roots, the mycelium of which works within the cortical parenchyma. These forms are now being experimented with, to determine if healthy vine roots can be infected by means of their spores. I cannot at present say that I think such will be the case.

During the microscopical examination, certain parts of the vine were found more or less infected by bacteria, and in deference to the views held by some European students, we have considered it advisable to inaugurate a series of inoculation experiments with these germs. The matter was taken up here, but afterwards transferred to Washington, owing to the all-pervading nature of the disease in this region, and the difficulty of keeping plants free from it. These experiments and numerous grafting experiments are now under way at the department, and it is yet too early to say what will be the ultimate result.

As to remedies and preventives, I will say that numerous tests have been conducted with various substances, and under many conditions; but the whole may be summed up by saying that what may be properly

termed a remedy or preventive is not yet known. The Bordeaux mixture is a great stimulant, and may be properly used as such, but it does not fill the place of a preventive or cure.

I have recently received some letters from the department where they have been carrying on experiments. The first letter says: "Two more of our inoculated vines are beginning to show signs of disease." Also another letter of March third: "Three of the vines inoculated above ground two months ago are beginning to send out very peculiar shoots. In some cases the leaves are covered with purplish brown spots or blotches, while in other instances they are streaked with yellow, which shades off to a green toward the principal veins."

Of course, it is my intention to go to Washington within two or three weeks, and I will be able to tell then, probably, whether it is the same trouble or not.

VOTE OF THANKS.

Mr. Eisen: I move that a vote of thanks be tendered to the Department of Agriculture in Washington for what it has already done and for what it proposes to do for this disease, which all of us know is of such great importance to us in this country.

Mr. Paine: In seconding that motion I want to congratulate ourselves upon having a man among us (Mr. Pierce) who is making such a careful and thorough study.

A Member: And to thank him for the efficient way in which he has said this, and for his kindness in coming here and telling us.

Motion carried.

Mr. Pierce: Gentlemen, I thank you all. I try to do my best; that is all I can say.

Mr. Eisen: I think the seriousness of the case warrants us to go out of order and take up this matter of importance. I understand the department in Washington has not all the means at its command to carry on this as it should be. For instance, I think it is of great importance that an expert should be sent to Europe to study the disease there and see if it is the same thing we have got, and to find out what remedies have been used, and anything else that belongs to the disease. I beg to offer the following resolution:

Be it resolved by the fruit growers of California, convened under the auspices of the State Board of Horticulture, that

Whereas, An undetermined and deathly disease of the grapevine has already destroyed many thousand acres of our formerly most fertile and productive vineyards in the State of California; and whereas, this disease shows no abatement in destructiveness, but is constantly spreading over new territory; and whereas, the Division of Vegetable Pathology of the United States Department of Agriculture, which is now engaged in the investigation of this disease, feels the need of more liberal appropriations of funds to enable it to continue and properly maintain its work now well advanced; be it, therefore,

Resolved, By the fruit growers of California, in Convention assembled, that the Secretary of the State Board of Horticulture shall at once place these facts, in the form here presented, before each of our representatives in Congress, with the request that they will take united action in presenting and urging the great necessities of the case before the Committee on Agriculture of the Congress at Washington, D. C.

Adopted unanimously.

TARIFF ON FRUITS.

Essay by F. A. Kercheval, Los Angeles.

Closely cordoned about by tropical and semi-tropical lands, east, west, and south, "where every prospect pleases, and only man is vile," and his labor very cheap, when required at all, to gather what Mother Earth almost spontaneously produces in the greatest profusion, is it not just and proper that we should demand ample protection against the blight of competition by ignorant and semi-barbarous coolies, South Sea Islanders, peons, and slaves, in the surrounding lands? Governments, like heads of families, must, first of all, cherish and look after the happiness and material welfare of their own children as against the rest of the world, else they cannot long expect love, reverence, and obedience, and are doomed to perish. We could not, as freeborn American citizens, take kindly to a costume of fig leaves or breech-clout, a sombrero and poncho, a gunny or flour sack about the loins; or to a diet of rice, poi, or taro, or tortillas and frijoles, and the munificent compensation of 10 or 15 cents per diem. Patriotism would perish were we compelled to live in wretched thatched huts or miserable jacals with earthen floors, in order that we might be able to compete with degenerate races, in whose breasts centuries of oppression have extinguished all high and noble aspirations. Nor yet should the products of overflowing pauper labor from the lands bordering upon the Mediterranean and other teeming regions of the old world be permitted to be dumped upon us, smothering in its infancy an industry that, with proper protection, would soon make us the glory and pride of our own continent and the envy of the world.

But let us calmly look at the circumstances by which we are surrounded, and the dangers by which we are threatened, and act accordingly. It is already plainly apparent that the present almost nominal duty upon citrus fruits, raisins, walnuts, almonds, figs, currants, prunes, olives, and oil, is entirely insufficient, as a means of protection to us against cheap capital, cheap transportation, and starved labor, that will confront us with ever deadlier menace, year by year, with their and our own ever increasing production. But a few days since the telegraph announced that in one week the amount of oranges received at our eastern ports from the Mediterranean was equal to the entire crop of California for this year, completely demoralizing, for the time being, the markets for our California and Florida productions. And the temptation to those countries will always be irresistible to flood our markets with their surplus, so long as the duty and ocean freight combined amounts to little more than one half the rate our own producers are compelled to pay for transportation to the same points, or even to reach the Mississippi Valley. From the tropical islands, laved by the torpid waters of the gulf stream and the Caribbean Sea, from the coral-guarded isles that gem the broad expanse of the South Pacific, from the broad curving palm-shaded coast lines of our own continent, stretching away through the equatorial regions down to Brazil on the east and Chili on the west, where fruits grow spontaneously, and man's wants are few and simple, where he "rests" for regular occupation and labors for pastime, will pour an ever increasing tide of competition, as the facilities for transportation and preservation in transit are cheapened and perfected.

But it is to our own immediate neighbor in the south, whose territorial line is coincident with our own for fifteen hundred miles, that we may look in the future for the deadliest menace to all our varied horticultural and pomological interests.

There, in the future, will be produced, in the greatest profusion, every fruit and every product of the temperate, semi-tropic, and tropic zones that is known and prized by the commercial world. There, right upon our border, from San Diego on the west, to the mouth of the Rio Grande on the east, lie almost limitless areas, stretching away down to the southward, much of it as near, or nearer to our great centers of population than California. Into every portion of this immensely rich domain, railroads connecting directly with our own great interior system are rapidly penetrating, giving Mexico quite as good and cheap facilities for transportation as California enjoys. Already, from Hermosillo and Guaymas, in the State of Sonora, and other points, considerable quantities of oranges, lemons, and limes of the finest quality reach us, both by sea and land. Millions of grape cuttings are being planted upon lands worth 25 or 50 cents per acre, by the aid of wretched peon labor, at the rate of 1 real per diem; and an income of $5 per acre, or even one half that amount, will be a princely income to the great land barons produced under such conditions. Think of it, ye raisin growers of Riverside and Fresno, with lands worth from $100 to $300 per acre, and labor from $1 to $1 50 per diem, and calculate the duration of your prosperity when forced into such deadly competition as you will surely be in the near future. Think of competition with such cheap lands and labor, Oh! brethren of the "Northern" and "Southern Citrus Belts," where orchards are worth $1,000 per acre, and let all foolish jealousy and bickering cease in the presence of the threat of common and overwhelming calamity.

The duty at present upon oranges is but 25 cents per box, or $1 60 per thousand, loose. In box, duty paid, the Mexican can place his oranges or lemons upon the cars at a price as low or lower than 50 cents, and realize what to him would be a good profit on his investment; but by shipping loose, in bulk, and but the choicest and largest fruit, the duty can be reduced as low as 10 to 15 cents per box, thus enabling him to place them upon the cars free, at a rate of 25 and 30 cents. Already the Mexican and State Governments of that republic are offering extraordinary inducements in the way of subsidies and exemption from taxation for a term of years, to those planting orange orchards and fruit trees of any kind.

Let our growers of figs, prunes, peaches, apricots, and olives look well to the land of the Montezumas, for the "cloud no bigger than the hand" will by and by assume portentious proportions.

Let us note some of our specialties of production requiring patient and careful manipulation in preparation for market, the present duty thereon, and find what the Mexican, with his almost valueless lands and labor, can afford to sell them for when he shall have produced them in sufficient quantities to enter into serious competition with us. Beginning with oranges, duty as now from 10 to 25 cents per box, he can sell them at from 25 to 50 cents; lemons, 5 to 10 cents higher; raisins, duty, 2 to 3¼ cents; figs, duty, 2 to 4 cents; plums, dried, 1 to 2 cents; prunes, duty, 1 to 2 cents; peaches, pears, apples, and apricots, which pay no

duty, he can place upon the cars, fresh and dried, at 1 to 2 cents per pound.

It must be apparent, then, to every one, that to protect our most promising industries in the future against the cheap capital, transportation, and pauper labor of the old world, and the cheap lands and peon labor of the new, a material increase in the tariff rates—at least double—should be imposed upon all fruits now taxed, and those now classed as free, including olives, should be placed upon the protected list, and made dutiable accordingly. Notably, upon oranges and lemons, which are soon perishable and cannot be preserved by drying, the rate should be increased to at least $5 per thousand, loose, or 75 cents per box. Before the close of the present century the production of oranges and lemons upon this coast will be enormous, probably twenty-five million boxes, perhaps much more, and with proper protection all our other fruit industries will increase proportionately.

To produce, handle, and move these vast aggregates will require the labor of one million men, women, and children, for which they should receive such compensation as will give them good homes and insure their comfort and happiness. And of not less magnitude and importance are the fruit industries of Florida and the Gulf States of the Union. In conjunction, we shall soon flood the United States and all the continent northward with the "fruits of the Hesperides," and none shall be so poor that they may not partake freely thereof. Only let our Government protect her children against the insidious encroachments of foreign capital and pauper labor, and peace, plenty, and prosperity shall be our lot, and strength enduring, and glory eternal, hers forever.

DISCUSSION.

JUDGE AIKEN: To bring the tariff question before the house and limit the same, somewhat, to the articles that probably will be recommended by the Finance Committee of the house for an increase of duty, I beg to offer the following memorial:

To the honorable the Senate and the House of Representatives of the United States, in Congress assembled:

Your memorialists, the fruit growers of the State of California, assembled at Los Angeles, this fourteenth day of March, 1890, most respectfully represent:

That they are engaged in raising fruit in California for consumption in the United States in competition with foreign fruits.

The soil and climate of this State are adapted to the successful production and preparation for market of green and dried fruits of excellent quality and in quantities sufficient in amount to supply, at an early day, the demand for such fruits in the United States.

The competition, however, with foreign fruits, raised and prepared with cheap foreign labor, has become so close that the present duties of 25 cents per box upon oranges, and 1 cent per pound upon prunes, have, in reality, ceased to protect these great industries from such disastrous competition.

Your memorialists, therefore, respectfully and earnestly request that the duty upon oranges be increased to 25 cents per cubic foot, or $4 per thousand, and the duty upon prunes to at least 3 cents per pound, and that all other duties on fruits and nuts be increased in a like proportion.

JUDGE AIKEN (continuing): Mr. President, I move its adoption.

Motion seconded.

MR. ROWLEY: Before that motion is put I would like to read an extract from a letter I have just received from New York. It is in ref-

erence to the dispatch that was received by the Foreign Fruit Exchange from the President of the Italian Chamber of Commerce. He urges, in his dispatch, that the foreign importers of New York use their best endeavors to defeat the following action, which, he says, is sure to take place through the recommendation of the Committee on Ways and Means: "The duty will be increased on a box of oranges to 25 cents per cubic foot. The ordinary box which comes from Valencia and elsewhere contains two and a half cubic feet, which makes 62½ cents duty. The case of Valencia oranges contains double the quantity of a box, which is five cubic feet, making the duty on that $1 25." So that in the face of this news I would suggest that Mr. Aiken make his recommendations in accordance with what they are about to do, and not lessen that amount—62½ cents a box in place of 50 cents.

JUDGE AIKEN: I am very happy to receive that information. I had made inquiries about that, but could not ascertain the exact amount, and I am happy to receive it.

The motion to adopt the memorial as offered by Judge Aiken was put to a vote and adopted unanimously.

LEGISLATION.

JUDGE AIKEN: Mr. Chairman, there is a committee to report at this meeting, appointed early in the session, and it is very brief, as follows:

Your Committee on Legislation respectfully report: That it is most desirable that further legislation may be had, but that owing to the importance of the subject no consideration or action can be had at this meeting, and therefore ask to be discharged. Your committee would recommend an appointment by the President of a standing committee of five to act as an advisory legislative committee to the State Board of Horticulture.

Mr. Buck moved that the committee be discharged, which was seconded and carried.

JUDGE AIKEN: I move the President appoint a standing committee of five to act as an advisory legislative committee to the State Board of Horticulture.

Seconded and carried.

THE PRESIDENT: I have named as a committee to draw a memorial to the United States Congress, with reference to procuring an appropriation for sending an entomologist to Australia and adjacent islands, William H. Aiken, George Rice, and I. H. Thomas.

NEXT PLACE OF MEETING.

THE PRESIDENT: It will now be in order to take up the discussion relative to the place of holding the next Convention. And before I take my seat I will state that I was delegated by the delegate from Santa Rosa, who was requested by the County Board of Horticultural Commissioners of Sonoma County, as well as by the State Board of Trade of San Francisco, to present the name of Santa Rosa as the proper place to hold the next Convention.

JUDGE AIKEN: I wish to present the name of Santa Cruz, and offer this resolution:

Resolved, That the State Board of Horticulture be requested to arrange for the fall meeting of the State Fruit Growers' Convention this year at Santa Cruz.

Mr. E. W. Maslin: At the request of the citizens of Marysville, Yuba City, and the counties of Yuba and Sutter in particular, and of the north in general, I present their request to this Convention asking that the next State Fruit Growers' Convention be held at Marysville.

The merits of the various places for holding the next Convention were presented by the delegates from the various localities so requesting it. The final vote resulted in a unanimous request of the Convention that the State Board of Horticulture be requested to call the next Convention to be held at Santa Cruz.

MEMORIAL TO CONGRESS.

The committee appointed to prepare a memorial to Congress, as to parasites, presented the following memorial, which was adopted unanimously:

To the honorable the Senate and the House of Representatives of the United States, in Congress assembled:

Your memorialists, the fruit growers of the State of California, in their annual Convention assembled, at Los Angeles, this fourteenth day of March, 1890, most respectfully represent:

That the climate and soil of this State are adapted to the growth and preparation of fruits of good quality and in quantities sufficient eventually to supply the demand for such products in the United States, especially prunes, raisins, figs, olives, and olive oil.

The success of this enterprise is of the greatest importance to the State and nation.

That the spread of scale insects from foreign countries in California threatens the continued successful cultivation of fruit trees subject to their ravages. Parasites have been found in foreign countries—especially Australia—that live upon and destroy the scale.

Your memorialists, therefore, respectfully and earnestly request an appropriation that will enable the Department of Agriculture to import to this country parasites for scale insects.

FINAL RESOLUTIONS ADOPTED.

Resolved, That a vote of thanks of this Convention be tendered to its President and the officers of the State Board of Horticulture for their fairness and ability in presiding over this Convention.

Resolved, That this Convention return its thanks to Fred. C. Miles for his kind attendance in seating this audience during the session of the Convention.

Resolved, That all persons who desire to contribute towards the Koebele fund be requested to send their subscriptions to the Secretary of the State Board of Horticulture, No. 220 Sutter Street, San Francisco.

Resolved, That the thanks of this Convention be tendered to the railroad companies for reduction in rates and extension of time on expiring tickets.

Resolved, That the thanks of this Convention be given to the citizens of Los Angeles for the hearty welcome and courtesies extended. That we thank the Chamber of Commerce for the active, enthusiastic reception accorded us. That we thank the Cross Railroad Company for an excursion to Pasadena, and also the citizens of that place for their cordial reception.

The Convention then adjourned *sine die*.

B. M. LELONG,
Secretary.

SUPPLEMENT

TO THE

REPORT OF B. M. LELONG,

Secretary of the State Board of Horticulture.

EX OFFICIO HORTICULTURAL OFFICER.

THE MISSION OLIVE.

A TREE OF GREAT LONGEVITY—ITS EARLY INTRODUCTION INTO CALIFORNIA, AND NOTES.

The Mission olive is among the first of trees that were introduced into California; and from the authorities at hand it appears that prior to the introduction of this tree but few fruits were known. Most of the fruits then consisted of seedling peaches, apples, pears, quinces, pomegranates, and grapes.* They were so inferior in quality that the "prickly pear" (*Tuna opuntia*) ranked first in favoritism among the people.

"I remember the time when there was no fruit raised in California, except at the old missions. Some attempts were made on the ranches to raise a few grapes, and perhaps a few pear trees, but they were invariably failures, so far as I know." †

The Mission olive is supposed to have been introduced into California from seeds brought from San Blas, Mexico, by Don Joseph de Galvez, during an expedition to rediscover the port of Monterey.‡ On the suppression of the Jesuit order in Mexico, in 1767, and its consequent expulsion from all the Spanish dominions, it was decided to send a body of Franciscans to take charge of the Jesuit missions in California. These were all in Lower (Southern) California, no attempt at settlement having yet been made in Upper (Northern) California. The band of missionaries numbered sixteen. Father Junipero Serra § was put in charge of it, and was appointed President of all the California missions.‖

It appears that the purpose of the Spanish Government was to proceed as soon as possible to the colonization of Upper (Northern) California. Among those representing the King of Spain in inspecting the the work of the Government in every province of the Spanish Empire, was Don Joseph de Galvez, who held the office of "Visitor-General" and "Commander." Upon him rested the responsibility of the practical organization of the first expedition into Upper (Northern) California. It was he who ordered the carrying of all sorts of seeds of vegetables, grains, and flowers; and everything that would grow in old Spain he ordered to be planted in the new.¶ From this expedition resulted the establishment of the San Diego Mission, the parent of those of San Gabriel, Santa Barbara, San Luis Obispo, and others, to all of which the fruits which Galvez had introduced were carried, and there throve abundantly.

The first seeds of the olive are said to have been planted at the Mission San Diego in 1769, and those seeds which Galvez had been so provident in sending took root and prospered. The fathers built new missions, and among the first fruit trees planted was the olive. The

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* Known as the "Mission" grape, and the only variety then grown.
† General John Bidwell, in an address before Fruit Growers' Convention, 1884.
‡ Bancroft's History.
§ His baptismal name was Joseph Michael, which he changed to Junipero on becoming a monk.
‖ History (imperfect) of Franciscan Missions in California.
¶ "Records of the Founding of Missions."

EXPLANATION OF PLATE I.

THE OLIVE.

Figure No. 1. Branch of Mission olive, showing the ripe fruit as borne upon the branches in clusters; also the characteristics of the fruit, leaf, and pit; natural size and color, when mature.

Olive Trees at Mission San Diego, Over a Century Old, Being the First Planted in this State, and Still Doing Well.

said to belong to the times of Louis d'Angio, Governor of Calabria. Some of them have trunks of extraordinary size, empty inside, in which many persons can stand. Thiebaut de Bernaud describes an olive tree situated between Villefranche and Nice, which was already known in 1850 to be exceedingly old, whose trunk, at three feet from the ground, measured twenty feet six inches in circumference. One near Marseilles is mentioned by Ceyreste, which is thought to be nine hundred to one thousand years old, and so gigantic that it can harbor in its interior twenty persons; and another at Tarascon, on the top of a hill, with branches seventy feet long. It is asserted by Gasparini that he has seen, near Rogliano, in Corsica, olive trees fifty feet in height. Very beautiful and fruitful wild olive trees are admired at Mount Amiata.

Repetti, writing of Magliano, Tuscan Marèmma, mentions the gigantic olive trees spoken of by the naturalist Giorgio Sauti, in volume two of his "A Trip in the Province of Siena." The stem of this tree measures thirty feet in circumference. It is yet standing.

In 1853, at the Fair of Paris, there was exposed the trunk of a wild olive tree of Algeria, thought to be one thousand years old.

On Tianosa Island (Tuscan Archipelago) there are olive trees of such immense size that they must have been in existence before the cession of the island, that is, before 1600.

It is related by Targioni that on the hills of Fiesole there was an olive tree as large as an oak, and known under the name of Michael Angelo; in fact, that property belonged to the Buonarroti family, and, according to the tradition, that tree was planted by Buonarroti himself. The same writer speaks of another olive tree, on the hills of Bagno a Ripoli, off Candela, supposed to have been planted by St. Antonius, Archbishop of Florence, who died in the year 1445.

Tgnazio Lavaggi advised in one of his letters to visit the celebrated groves of olive trees near Tivoli, one of which, and very likely it is there still, could not be embraced by three persons, and had branded on its trunk the design of a sword, which seemed very old.

Professor Caruso writes: "The most remarkable olive trees I have seen are situated at some maritime places of Sicily (plain of Palermo and Milazzo), in the forest of Pertinicio, on the coast of Ætna, in the plains of Syracuse, in Calabria (plain of Palmi), and in Puglia (Terra d'Otranto). Their majestic appearance is justly attributed to the general practice of the ancient cultivators of those regions of multiplying the olive trees with the wild species gathered in the woods and grafting them very high from the ground. The enormous height is the effect of the olden order of pruning the trees very little or none at all, so that they grew thick and confusedly, as in a thick wood, forcing the branches to stretch up continually in search of air and light. This is the reason why the old groves of the plain of Calabria, at about one mile from Palmi, have the appearance of long poles, dressed on top with a scarce foliage and a quantity of dried leaves, which make a striking contrast with the vigor of the trees, the mildness of the climate, and the fertility of the soil."

As Bianchedi writes: "We are not permitted to-day to see the celebrated forests of olive trees, under which rode, in 1482, Marin Sannto; nor can we see the town of Salo, at Gargano, full of olive trees, which, as is related by Roga, were extolled, in 1558, by Leandro Alberti. Of that large and luxuriant surface there remains no trace to-day. The

last one, said to have been planted by St. Francis, at the beginning of the thirteenth century (Canevari: Agricola Italiana, 1883), was admired by many some twenty years ago, on Lechio Island, or Frati Island."

At the various missions throughout the State may be seen olive trees that were planted, according to history, over a century ago. These trees yet bear good and regular crops with but little attention.

Notably among the largest olive trees are those at the Mission San Fernando, but those at San Juan Capistrano, Orange County, have much thicker bodies. A tree at the Mission San José, Alameda County, supposed to have been planted there about fifty years after the introduction of this tree, is perhaps the largest olive tree in the State. Its trunk measures five feet eight and one half inches in circumference, at about two feet from the ground, and stands erect, and is about forty feet high. The fruits borne by this tree are large, and it bears a regular crop yearly, although larger in one year than in another; this is, however, the same, or nearly so, in the other places where these gigantic trees abound, and especially when they receive proper attention and care.

OLIVE OIL MANUFACTURE.*

SEASON AND MEANS FOR HARVESTING OLIVES.

It is of the utmost importance for the manufacture of olive oil to determine the time and manner in which the olives shall be gathered.

There is a great diversity of opinion as to the proper time for picking the fruit from the tree. A few horticulturists, modern ones even, prescribe that the olives be gathered late in the season, because, in their judgment, they then yield more oil in proportion to their weight.

It is owing to such a conviction that in the greater part of Italy the olive is harvested rather late, and, in fact, when it falls of itself from the tree on account of its excessive ripeness; and it is also due to such a practice that the greater part of the Italian oil-producing regions give oils that are little or not at all appreciated.

Such a practice ought to be stopped absolutely, since it carries with it grave and many evils. First of all, one must bear in mind that the greater quantity of oil which seems to be obtained from late-gathered olives is but apparent, as the fruits lose the water of vegetation during their prolonged stay on the tree, and hence yield, necessarily, more oil with less weight. Thus, a given quantity of olives, if gathered in November, for instance, will weigh less if gathered two or three months later, and the amount of oil obtained from it will appear larger when compared to the reduced weight of the fruit.

Besides, the oil extracted from olives gathered late is very much inferior to that yielded by early picked ones.

In order to get good oil the olives must be picked as soon as they begin to turn black, and pressed immediately. Many modern authors, Caruso among others, condemn the delay in harvesting the olives as injurious to the quality of the oil.

To demonstrate by facts the truth of these assertions, I take pleasure in pointing out the results of an experiment I made on this subject in the course of the year 1880.

On the first of November of that year I had some olives of a very small species picked from a tree; they were nearly ripe, as was evidenced by the vinous tint assumed by the fruit, and the ease with which it parted with its skin. I measured one quart of these olives, and found they weighed 1 pound 13 ounces. I next counted them and ascertained there were four hundred and ninety-five; so that the average weight of each olive amounted to $25\frac{81}{100}$ grains. I then extracted the oil from this quart of olives and secured about $5\frac{1}{25}$ ounces of an exceedingly fine quality, or 17.25 per cent.

On January 30, 1881, I had another quart of olives picked from the same tree. They numbered this time five hundred and eighteen, or twenty-three more than on the first of November, three months pre-

* By Professor A. Aloi, Professor of Agriculture for Italy. Being the latest information published on the subject.

vious. This showed that the fruit had diminished in size. I took four hundred and ninety-five of these olives, and ascertained their weight to be 1 pound 11 ounces, an average of $24\frac{14}{25}$ grains for each olive, instead of $25\frac{81}{100}$ grains as before; hence, there had been a diminution not only in the volume, but also in the weight; a decrease, in fact, of 4.64 per cent in the former, and of 4.84 per cent in the latter.

From the four hundred and ninety-five olives I extracted 5 ounces of oil, and about $\frac{1}{4}$ ounce from the other twenty-three, but it was of a quality much inferior to that obtained the first time.

Now, if these 5 ounces of oil be compared with the 1 pound 11 ounces weight of the four hundred and ninety-five olives, the production of oil in that case was 18.07 per cent, and therefore 0.82 per cent more was obtained from the olives gathered on the first of November, which gave 17.25 per cent. But if we make the comparison with the 1 pound 13 ounces weight which the same four hundred and ninety-five olives would have had on the latter date, the rate falls to 17.20 per cent; consequently the greater amount of oil which late-gathered olives seem to yield is only apparent.

If we compare the production of oil to the size of the olives used, the apparent difference in favor of the olives gathered late is still more marked. Indeed, the four hundred and ninety-five olives picked on the first of November, 1880, and which amounted precisely to one quart, gave only $5\frac{1}{25}$ ounces of oil; whereas, the quart of olives gathered on the thirtieth of January, 1881, and composed of the four hundred and ninety-five olives which yielded 5 ounces of oil, and of the twenty-three which gave $\frac{1}{4}$ of an ounce, produced in all about $5\frac{1}{4}$ ounces of oil, that is to say, 6.18 grams more, or 4.32 per cent.

From this experiment, and from what has been said before, one may well infer *that the prevalent belief, that olives yield more oil when harvested late, is one of those errors which it is absolutely necessary to correct.*

Besides giving rise to the fallacious belief just referred to, a delayed harvest still brings forth many inconveniences.

Above all, late-gathered olives give an oil of poorer quality. This fact was noted even by Columella, who, despite his opinion that very ripe olives yield more oil, could not help but acknowledge that its quality was impaired. Indeed, he says on this subjeet: "The riper the fruit, the harsher and less agreeable the juice."

Besides, by remaining a long time on the tree the olives weaken the plant very much and hinder the formation and growth of new buds; consequently, the next crop is always light.

Also, the longer the fruits are left on the tree the more are eaten by the birds, which are fond of them. The olives, moreover, are then subjected to rough weather and frost, and large quantities are carried away by the rains, while the oil obtained from the remainder is less abundant and of lower grade.

That the olives harvested in freezing weather give less and a poorer quality of oil, has been proved by the experiments of Professor Bechi. Here is how he expresses himself on the subject: "But, in delaying the harvest until the olives are perfectly ripe, it frequently happens that they are caught by a sudden frost, and then, as is well known, they yield a lesser quantity and an inferior quality of oil. Wishing to observe this phenomenon more closely, we took a certain quantity of olives and produced their congealment artificially by means of ice and salts, just

as is done by Nature herself, when the lowering of the temperature causes the water to freeze. The olives were penetrated by the cold, and a few days after we put them into the press and extracted the oil. A little clear oil flowed at first, but there soon began to come out a mass of paste, from which the oil could be separated only through the use of a great deal of boiling water. It is true that if we reckon the total amount of oil obtained from the frozen olives, none of it was lost, though it was full of dregs, and upon a close examination it was found to be as abundant as in the sound olives. We may say this, however, in regard to the congealing of olives: It is known that when the oil is exposed to the cold, its components become separated; that is to say, the stearine and margarine from the oleine. The fluid part exudes freely from the tissue of the olive, while the solid part remains firm within the cells. But the tissue of the frozen olives is torn by congelation, and is, therefore, easily modified by the mingling of the albuminoid matters. The unpleasant and harsh taste acquired by the oil emanates precisely from the alteration of the substances which form the food of the olive, and the oil mixed with that being richer in solid matters, does not become fluid and flow out, except with hot water and by means of heat. The admixture of the azotous matters, which is brought about by the rupture of the cells, is the cause of an incipient fermentation, and of that peculiar odor and taste which the oil so readily attracts and appropriates."*

After all that has been said, it is to be hoped that no one will any longer contend "that delay in the harvesting of olives is injurious to both the quality and quantity of the oil," and that it should, therefore, be avoided.

On the other hand, the premature gathering of the olives is injurious to the quantity of the oil, but not to its quality.

If the olives be taken off the tree very early, they give a palatable and delicate oil, and one which tastes of the fruit, but the quantity will be rather small.

Professor Bechi, whom we have just cited, came, after some experiments, to the following conclusions:

"That early-picked olives give the best quality of oil, but a little of it is lost, especially by remaining mixed with the dregs; that well-ripe olives yield a little more oil."

The olives should, therefore, be gathered when they have reached that degree of maturity which would insure the greatest quantity of oil of good quality.

The olive is ripe when it assumes a deep violet color, tending to a rather clear black, and the pulp is easily detached from the stone. Then it contains:

Pulp	51.26
Water	14.38
Stone	20.16
Residue	8.88
Oil of the kernel	0.06

He, therefore, who wishes the finest oil must not wait until the olive has reached complete maturity, but it is necessary for him to anticipate somewhat the harvest. It is not to be inferred from this that ripe olives give oil of inferior quality. One has to make a distinction be-

* Bechi, "Saggi di Esperienze agrarie," No. 14, Florence, 1874.

tween fine oil and that which is very fine. Ripe olives give fine oil and a larger quantity. Olives that are a little unripe yield the finest oil, but the quantity is somewhat smaller. It is well to state, however, that in some regions the oil thickens very much in the pulp cells of the olive that has turned black, and becomes charged with coloring matter. It is advisable in that case to gather the olives a little before they have attained true maturity if fine oils are desired.

The following deductions may be drawn in consequence in regard to the season in which olives should be harvested:

First—Olives picked a little before maturity give the finest oil, but some of it is lost.

Second—Olives gathered when just ripe furnish the greatest quantity of oil, and it is of good quality.

Third—Olives harvested late yield an oil of inferior grade.

Fourth—In southern climes the formation of the oil within the pulp of the olives is perfected a little before the fruits have reached complete maturity.

The season for harvesting the olives having been determined, it is now time to consider the second question pertaining to this chapter; that is, the manner in which the olives have to be gathered.

The evils resulting from the natural fall of the olives are about as follows:

First—By prolonging the olive harvest one has to incur larger expenditures, and encroaches upon time which should be devoted to other occupations no less important.

Second—Late-gathered olives always give an oil of inferior quality.

Third—The birds and animals fond of olives have an opportunity to devour a large quantity, and hence the production is smaller.

Fourth—The rains and the winds are given more time to bring destruction and make more serious ravages.

Fifth—To lengthen the stay of the olives upon the tree does harm to the fructification of the following year.

The harvest based upon the natural fall of the olives should be, therefore, absolutely proscribed.

The harvest made by beating the fruit down with poles is no less to be proscribed, or rather, forbidden. This illy advised mode of gathering the olives, so much in vogue, should be abandoned absolutely and forever. Knocking down the olives, as is done for nuts, is most injurious to the plants. Striking the trees in this way ruins the product of the subsequent year, because the olive bears fruit on the two-year old wood, and in beating down the olives with sticks there occurs a great destruction of shoots upon which the future crop depends. This inconsiderate practice has given rise to the false belief that the olive is a plant which fructifies every other year. If we destroy the shoots which would fructify in the next year it is but natural that the plant would not give fruit in that year.

One cannot have an idea of the damage caused by beating down the fruit. A plantation of olives that have been struck with poles looks as if it had been visited by a severe storm. The ground is literally covered with broken shoots and the trees can no longer be recognized, from rough usage, their heads being in disorder and shorn of their more tender parts, or presenting bent shoots partly fractured and hanging. With a little attention, one may readily perceive that the tender shoots

are almost totally destroyed, part having fallen on the ground, part being broken and pending from the tree, part being bruised. A storm could not produce like damage.

These are not the only evils brought by the use of the stick. The plant is injured in its bark at several points, a considerable number of buds, which fill an important function in vegetable life, are torn and ruined, and finally the olives undergo lacerations and contusions, either directly in being hit by the pole or on account of being dashed against the ground, which excites an early fermentation, while part of the fruit is lost by being hurled far away from the tree.

The ancients knew better how to appreciate the olive; they forbade, by law, the beating of the precious tree of Minerva. So great was their veneration for it that they respected, religiously, the famous precept which formed part of their code: "Do not cut or strike the olive."

I understand that sometimes the tallness of a tree and its peculiar position compel the olive growers to use a stick to gather the olives; but there is a great difference between a general use of the pole and its employment in a special circumstance. In the first case it is considerable; in the second, it is barely excusable. I say excusable, because, instead of striking the big trees, it would be better to shake them, as this would produce the same effect with regard to the gathering of the olives, and not be subject to the disadvantages already enumerated. But if one be so obstinate as to persist in beating instead of shaking the fruit off the big trees, he should at least be cautious enough to use canes instead of poles, and take care not to break and knock down the tender shoots upon which the future fructification is dependent.

The best and most commendable way to gather the olives is to do it by hand, since thus are avoided the evils produced by beating down the fruit or by its natural fall. When the olives are picked by hand the tree is not injured in any part; the shoots destined to bear fruit are not broken or bruised; the olives can be taken off the plant in due season, and hence, not only is the future production not curtailed, but healthier and nicer fruits are obtained, and in greater quantity; thus producing more and a better quality of oil.

The olives that are picked by hand produce the finest oils, and are most esteemed in trade. It will be sufficient to cite the Province of Bari, in support of this assertion. The Province of Bari, which, prior to 1830, according to Dè Cesare,* was behind Kabylia, Greece, and Turkey, in the matter of oil production, and furnished most fetid and blackish oils, fit only to make soap or to burn, is to-day the model district of southern Italy, not only for the fabrication of oil, but also for the culture of the olive; in fact, it is the most progressive region after Tuscany. Now, in that province the olive harvest is done by hand, because the owners of plantations are sensible, and know what effect the manner of picking the olives has upon the quality of the oil. In the neighboring district, on the contrary, the Province of Lecce, which is the chief oil-producing region of Italy, and where are produced the worst oils, used only for burning, making soap, lubricating machinery, etc., the olives are not gathered until falling from the tree.

In Tuscany, that classical region of the olive oil, and especially in the Province of Lucca, where is produced that liquid which surpasses

*Relazione sugli oil commestibile alla Esposizione Universale di Vienna dell anno 1873, of R. De Cesare.

the most famous oils of all countries in fineness and delicacy, the olives are gathered mostly by hand. When the picking is done by hand, one should clear up the ground beneath the trees a long time before the fruit is ripe, in order to facilitate the gathering of such olives as the wind, a prolonged drought, or injurious insects might cause to fall. These olives are to be put aside after being gathered, and kept by themselves when expressing their oil, which is of inferior quality; and in no case should they be mixed with those picked by hand from the tree.

The proper time for harvesting having arrived, the tree is surrounded with large pieces of canvas, held rather tight. The pickers rub by hand the small branches loaded with olives and let the fruit fall upon the canvas. As soon as the stretched cloth is sufficiently covered, the ends are brought together and the olives dumped into baskets close by, which are then carried to the oil factory. The branches that are too high or too far away to be reached, may be stripped of their fruit by shaking, but never by striking. The shaking of the branches is done by means of an iron hook set at the end of a long pole (Fig. 1), or by a hook wholly made of wood (Fig. 2), both well padded at the curved end with cotton, to prevent injuring or tearing the bark, and consequently the buds. To use the hook, it is simply necessary to pass it over the branches and shake them repeatedly, thus forcing the olives to fall.

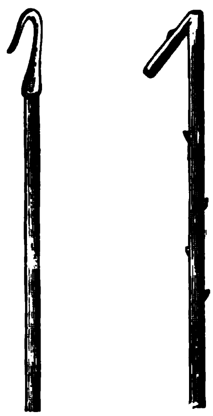


Fig. 1. Fig. 2.

It would seem at first sight that the gathering of olives by hand, as just described, must entail a larger expense than their beating down, but such is not the case; hand-picking is the most economical.

It is important also to have in mind the state of the atmosphere during the picking season. The olives should preferably be gathered on dry and sunny days. But if, owing to circumstances quite independent from the will of the grower, they have to be gathered in damp or wet weather, they should then be dried in the grove itself before being sent to the crushing-rooms. This may be easily done by spreading them over canvas or boards exposed to the sun and sheltered from the dust. Whatever be the mode followed in gathering the olives, it frequently happens that foreign matters get accidentally mixed with them, and the olives themselves are covered with dirt; it is advisable in that case to clean or wash them in the field. The washing of olives that are cov-

ered with dirt is easily effected by putting them into sieves provided with handles, and dipping them repeatedly into a basin full of water. They are then dried in the sun.

The olives, having been gathered and cleaned, it is now necessary to carry them over to the oil factory and pass them through the crusher and press. The transportation may be accomplished immediately after the harvest, or a certain time after. If, owing to either of the circumstances mentioned, the olives have to be kept in the field for a protracted time, it is necessary then to place them upon cloth or boards, in order that they may be kept clean and uninjured. One must also avoid putting them in heaps, but spread them out as much as possible, the layers not to exceed six inches in thickness, so as to prevent fermentation from setting in in the mass, which would ruin the oil, as will be shown further on. The olives should always be carried in baskets and never in sacks, as is practiced in a few places, because the olives in sacks are easily bruised, and even broken, and, consequently, they ferment if kept for any length of time at the factory, and the oil is spoiled. For the same reason one must avoid throwing the olives with violence into the receptacles.

It would be proper to speak now of the way to keep the olives in the oil factory, but I deem it useful to give first the description of the place where the oils are manipulated, and of the tools and machines required in their handling, and to this will be devoted the next chapter.

MACHINES AND IMPLEMENTS PERTAINING TO THE FABRICATION OF OLIVE OIL.

The machines and other implements necessary for the fabrication of oils begins with the crusher, which represents the first and most important machine of the factory.

We call the machine destined to crush the olives, preparatory to their being pressed for extracting the oil, a "mill," or "crusher."

The oil is contained in certain cells which form part of the olives, and it cannot come out unless they be broken; hence, one can readily understand the importance of crushing the olives. The best olive oil is that extracted from the pulp of the fruit, without cracking the stone, which also contains oil, but of inferior quality, and therefore the best crusher would be the one which could mash the pulp of the olive and yet leave the stone intact. But the science of mechanics, it must be confessed, has not been able so far to devise crushers of this description. There exist, it is true, a few machines designed with the view of directly separating the pulp of the olives by working it apart, but these do not answer the purpose well.

I have seen some authors* praise a mill answering the purpose of grinding the pulp of the olives without cracking the stone. In many of those in use a movable upper stone of the form of a truncated cone is imbedded in and surmounts a fixed lower stone of similar shape. It differs from them chiefly in having a special mechanism to increase or decrease the space between the two stones.

A sufficient space can be left between the two stones so that the pulp of the olives alone will be crushed, and not the pits; and the paste from this first grinding being put under the press will give virgin oil, and if the residue of the pression be passed again through the mill, keeping

* "Enciclopedia Agraria" of Professor Cantoni, Vol. IV, 7th part.

OLIVE OIL MILL AT MISSION SAN DIEGO, THE FIRST BUILT IN THE STATE (DATE UNKNOWN). SUPPOSED TO BE OVER A CENTURY OLD.

an arbor passing through its center, and which is fixed by one end to the board, and bears at the other a whiffletree for a horse.

Fig. 4.

The mortar consists of a circular well, the bottom or bed of which is made of hard granite, and surrounded by a wall lined with stone slabs united with good cement to prevent the escape of oil. In the well turns the stone, which is set in motion either directly or through gearing. There are, besides, two iron arms; one attached to the tree and the other to the axle which guides and drives the stone, and they serve to stir up the paste.

Many other crushers in use are similar to the one just described, differing only in that they have two stones instead of one.

Crushers can be made with two, three, or even four stones, moved by animals, either directly or indirectly, through gearing, or else by inanimate force, such as steam or hydraulic power. Instead of minutely describing these crushers, which would require much space, without giving a really complete notion of them, I deem it more useful to illustrate them by figures, so that the readers may form a much more exact idea of their construction.

In Fig. 4 is represented a crusher with three stones moved by animal power. The stones are sustained at different distances from the center by a cast-iron arbor provided with pivots, upon which they revolve.

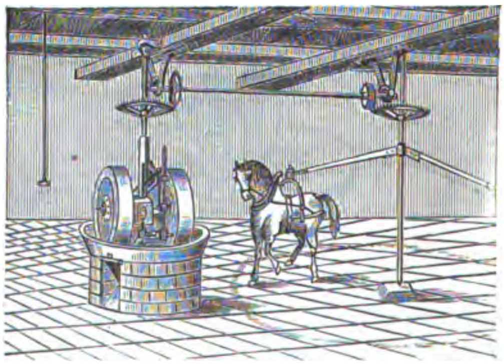
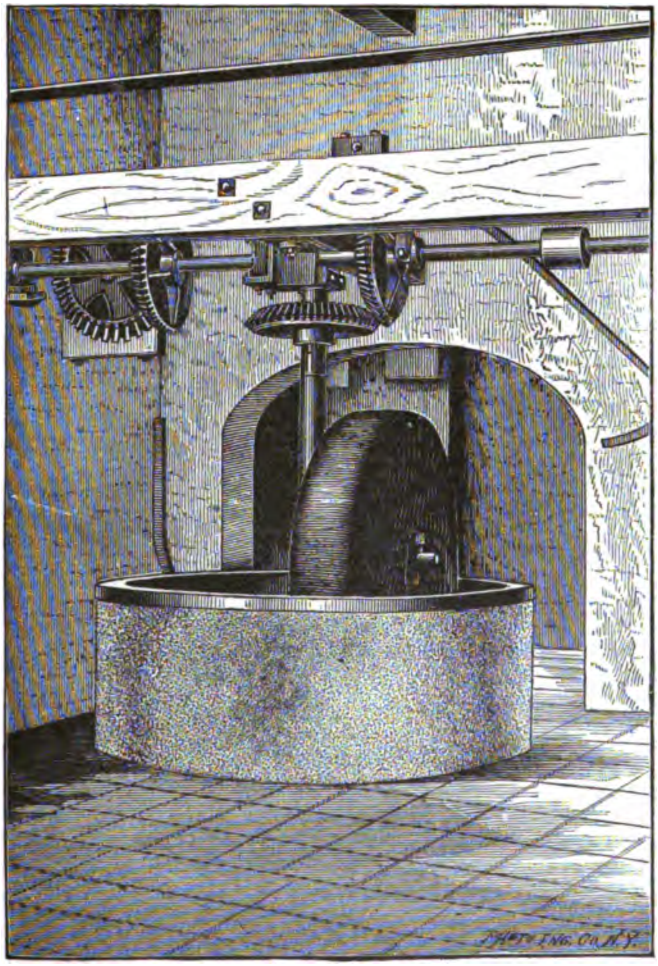


Fig. 5.

To the arbor is also secured a bar, to which is attached the animal which puts the stones in motion by dragging it.

The crushers, with two or four stones moved directly by animal power, are also built in the same way.

OLIVE OIL MANUFACTURE.



Samuel Rae & Co., Boston.

OLIVE OIL MILL, WORKED BY STEAM OR HORSE POWER.

Fig. 5 shows the application of horse-power to a two-stone crusher through the medium of gears.

The same type answers when the crusher has to be worked by inanimate force, such as hydraulic power or steam, it being only necessary then to suppress the vertical tree to which the horse is attached, and to provide the horizontal shaft with a pulley, as may be seen in Fig. 6.

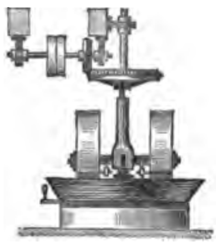


Fig. 6.

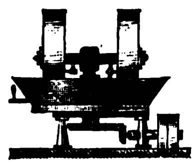


Fig. 7.

In Fig. 7 is shown a crusher with two stones operated indirectly from underneath, and which may be moved either by horses through gearing, or by a hydraulic motive force, or by steam. In large works, where inanimate power is used, these crushers driven from underneath are to be preferred, as occasioning less inconvenience and requiring no upper beam to support the shafting.

If one were to be governed by the famous old saying, "haste slowly," the palm would belong to the ordinary crusher, since it is held that the more slowly the millstone is turned, the better is the oil obtained. But customs change with the times; the sciences progress, the mechanical arts make gigantic strides, and hence some of the old maxims cannot and must not be followed any longer.

Olive growers who have devoted much time to the manufacture of oils oppose the crushers with two or three stones. They consider that no good oil can be obtained unless the millstone be moved slowly, that is, at the rate of six to eight turns a minute. A faster movement would cause the paste to heat and the oil to acquire that unpleasant taste called "heated." That an increase in the number of revolutions of the stone per minute causes the paste to become somewhat heated is beyond doubt, but that such a light heating causes the oil to lose in quality is not sufficiently proved, and therefore there is no great reason to depreciate the crushers possessed of two or three stones and moving a little faster than six to eight turns a minute. With such crushers the work can be doubled and trebled, and still the stones be moved with that slowness of speed which one may consider as the most apt to produce good oil. For these reasons the crushers with several stones must not be undervalued, but on the contrary, appreciated and adopted, because effecting a great economy in the expense of working the olives.

To grind the olives with the ordinary crushers is a long and painful task, and requires a great expenditure of time and labor, not to mention that it calls for the continuous employment of a rather skillful workman to watch the crushing of the olives, push them with a shovel under the stone, and draw them back after they have been ground; the operation, in consequence, is not only long and expensive, but also imperfect.

Much more serviceable are the crushers with troughs, which, according Caruso,* present the following advantages:

First—The olives do not escape from the basin.

Second—The attachments with which the crusher is provided take the place of the workman, and hence there is a saving of labor.

Third—Less motive force is required.

Fourth—It crushes the largest quantities of olives in the shortest possible time, thus saving much expense.

Now, if crushers present such advantages, the three-stone and four-stone crushers must present them in a greater degree. Indeed, the quantity of olives which can be put at each time into the different crushers, and which constitutes what is called a charge, is the following, to wit:

In one-stone crushers	264 to 352 pounds.
In two-stone crushers	352 to 484 pounds.
In three-stone crushers	484 to 660 pounds.
In four-stone crushers	660 to 880 pounds.

One easily understands that the advantage lies with the crushers having the most stones, not only because they grind at each operation a larger quantity of olives, but also because the latter are sooner subjected to the press. The importance of the establishment then shall determine whether it be expedient to adopt a crusher with two, three, or else four stones.

It is expedient, at any rate, to always give the preference to a single crusher with a double number of stones over two crushers with half the number, since the same work is performed with the first in a shorter time and with greater economy. Thus, a crusher with four stones is to be preferred to two crushers with two stones, because it accomplishes about the same amount of work, occupies less space, and requires a motive force of much smaller intensity.

As previously stated, the motive forces applicable to the crushers provided with one or more stones are the muscular power of animals and the inanimate power of hydraulic machinery and steam. It is impossible to lay down precise rules on this subject, since they are better determined by the nature of the establishment and its topographical position. I only say that for oil factories of minor importance it is expedient to use crushers moved by animals, and that for the large works preference must be given to those actuated by steam or hydraulic power. As regards economy, the motive force which should be preferred is the hydraulic, since it does not require the expense of fuel as the steam system, nor the feeding of animals, as the horse method, but it cannot be had only under certain peculiar local circumstances.

The steam system has the advantage over the horse system for quick work and the saving of labor, but it can be applied only in large oil factories, as otherwise it would not be profitable.

The application of hydraulic or steam power to the crushing of olives is condemned by some people on account of the heating of the oil already mentioned. It is contended that as the two forces cause the millstones to revolve more than six to eight times a minute, the paste becomes heated and the oil loses its quality. These assertions are, nevertheless, contradicted by facts. Many oil establishments crush the olives with crushers run by steam, and yet they obtain oils of the very

* "Trattato sulla coltivazione degli olivi e la manifattura dell olio," Palermo, 1870.

best quality, much sought for in trade. Likewise, there are some oil houses where steam is used.

These facts serve to prove also that there is exaggeration in contending that with the increase in the number of revolutions per minute of the crusher-stone the oil loses in quality. It is not a light momentary heating undergone by the paste beneath the stones which can ruin the oil, although a prolonged and rather strong heating would spoil the precious liquid, as it would cause the fermentation of the olives, and hence of the oil. The crushers with several stones moved by the inanimate force of either hydraulic or steam machinery may, therefore, be adopted without danger of not receiving an immense advantage from their use.

Some one has attempted to apply the hydraulic press to the extraction of oil, making it perform the office of crusher and press at the same time, but the result did not correspond to the expectation. In order that the oil may come out of the olives, it is necessary to break the cells in which it is contained, and this is effected by crushing and triturating. Hydraulic presses, however, merely squash the olives, and consequently the whole of their oil cannot be drawn out, whatever be the pressure. These presses do not, therefore, answer the purpose.

After the crusher, the most important machine of the oil factory is the press.

One of the roughest presses, which is still used in many factories, is the press called the Calabrian (Fig. 8).

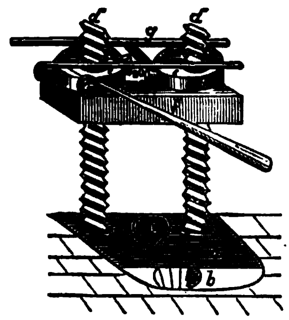


Fig. 8.

It is composed of a big block of wood, *a*, fixed horizontally upon the floor, close to a basin, *b*, containing a tub destined to receive the oil. In the middle of this block there is a disk, *c*, upon which are placed the bags filled with paste, and which is surrounded by a small channel destined to receive the oil and lead it to the tub. From the ends of the block rise two big wooden screws, *d d*, secured to the base and provided with inwardly-threaded disks, which by going up or down raise or lower another block, *f*, which expresses the oil on being brought down upon the bags filled with paste. It is this second block, therefore, which performs the function of a press.

The small ladder, *g*, which is placed upon the internally-threaded disks, is furnished with a big iron hook engaged by a ring, *t*, secured to the upper block, and as it goes up and down with these disks, it consequently forces the block to follow its movements.

The first downward movement of the threaded disks, and hence of the block, when the bags filled with paste have been stood up in place, is accomplished by hand, but afterwards recourse is had to a lever or strong bar of wood, *x*, the point of which is introduced between a corner of the threaded disks and a twist of stout rope, *z*. The bar is pushed by two, three, and even four persons.

More effective than the Calabrian, but still imperfect, is the Genoese press, which has been substituted for the former in many factories of the Calabrias, Sicily, and other southern districts of Italy. The Genoese oil press is nothing more than the percussion press, and it is represented by Fig. 9.

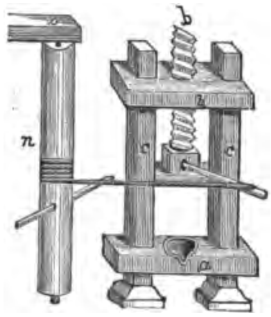


Fig. 9.

It also consists of two wooden blocks, *a* and *b*, set horizontally one above the other, and both fixed and kept in position at a certain distance apart by two pillars of wood vertically set up. In the middle of the upper block are formed internal threads, into which runs a screw, *d*, provided at its head with a solid disk of wood, which is lowered as the screw comes down and presses the paste bags stacked up on the disk, *s*, of the lower block and squeezes out the oil, which is received in a small vat underneath. In the head of the screw are bored four ball-shaped holes, set in the form of a cross, and into which is inserted the end of the operating lever. When the pressure increases, and the lever no longer answers, the latter is replaced by a bar, which is inserted at one end into the holes of the screwhead and attached by the other to a rope fastened to a capstan or windlass, *n*, composed of a vertical post moving on its own axis, and of a lever, *r*, set in the shape of a cross, and to which hand force is applied.

To the Genoese presses, as formerly constructed, have been made some modifications, consisting of the substitution of iron screws and threaded disks for the wooden ones. With these modifications the work is rendered easier. To-day, however, the presses made entirely of wood, or partly of wood and partly of iron, give place to the presses wholly made of iron, as the latter afford more commodity, greater solidity, and exercise a much stronger pressure.

Among other presses there are those with a simple lever, and those with a compound lever. The simple-lever press, shown in Fig. 10, is made wholly of soft and hard iron. The columns are of hard iron turned in the parts, which are set in the base and top, and they are only three in number, so as to leave a wider space within which to handle the lever. These presses were once built with four columns, but to-day

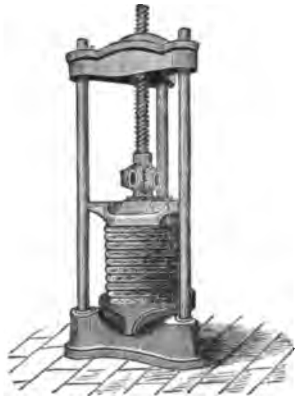


Fig. 10.

they are discarded, and those with three columns preferred for the advantage mentioned, that is, handling of the lever. The head and base are of soft iron. The screw is of hard iron turned on the lathe, and consequently these presses can exercise strong pressures. They are made in various sizes, and the pression they exercise varies from about fifty-two to one hundred and thirty-two tons.

Preferable to the one just described is the press with compound lever and continous movement, represented by Fig. 11, because it not only presents the simplicity and solidity of the simple-lever press, but exercises a much greater pressure.

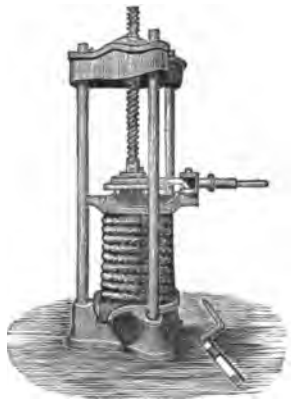


Fig. 11.

One man alone, with a simple backward and forward movement, which he imparts to the lever, can exercise as much as one hundred and ten tons of pressure. Moreover, the pressure of these presses is even, slow, and continuous, conditions which are favorable to the extraction of the oil from the olives.

Although the advantages of the compound-lever press over the simple-lever press cannot be disputed, I will state here the results of an experiment I made on this subject in November, 1880.

I took about twenty-one and one quarter gallons of olives, had them crushed, and afterwards pressed twice with a simple-lever press, as much as could be done, and in this way obtained four and one quarter gallons of oil. I then had the residue, which the laborers said could not contain a single drop of oil, subjected to a compound-lever press, and to the great astonishment of these same laborers it still yielded over two pints of oil.

Instead of having a disk in the lower part for receiving the paste bags, as the Calabrian and Genoese presses, the iron presses are generally provided with a metal plate having a high rim and a spout for conducting away the oil, like that shown in Figs. 10 and 11.

Fig. 12.

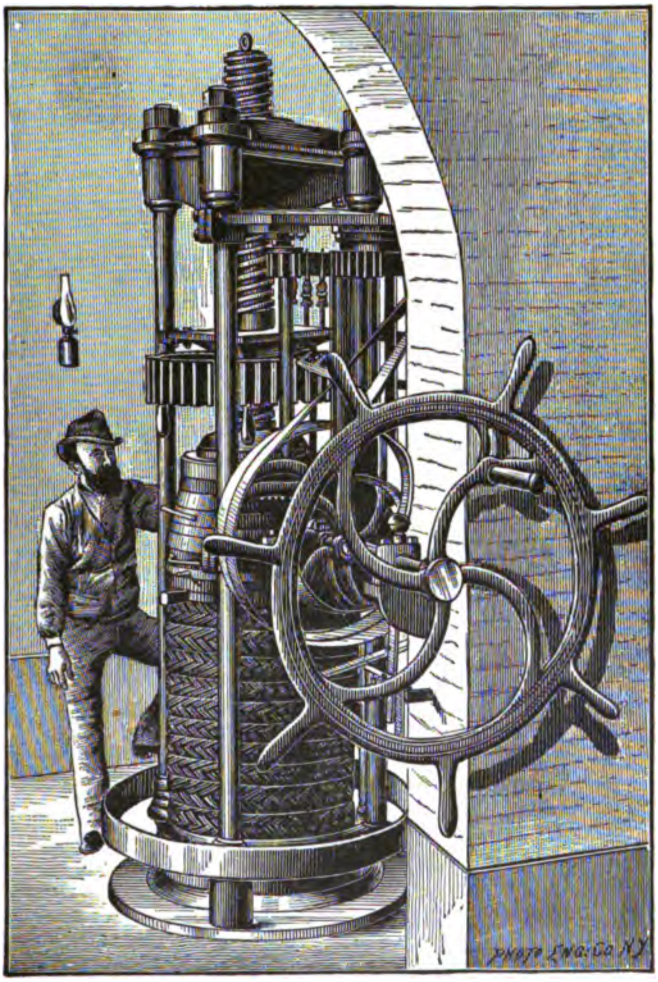
A greater pressure than that secured by any of the presses previously described, may be obtained with the hydraulic press. Of such presses, there are some built for the extraction of oil which can give as much as four hundred and forty tons of pressure. In Fig. 12 we have a type of the hydraulic press. Hydraulic presses, however, are not very suitable for the extraction of oil.

"Some oil makers," says Caruso, "have thought they could substitute the hydraulic presses for those mentioned (percussion presses). There is no doubt that they are more expeditious, and can be applied with great success to the extraction of oil from the seed of flax, spurge-olive, rape, ground-nut, etc., but it is well to repeat that the nature of the fruit of the olive is quite different from that of the other oleaginous plants, inasmuch as it requires both time and a prolonged trituration to liberate all the oil.

"The hydraulic press compresses with violence and force, and cannot produce any other result but that of compacting the grounds into a tenacious mass; the oil therefore remains imprisoned, and is lost in the oil-bearing cells which are not broken and disruptured.

"The oil does not flow out quickly, but it takes some time before it leaves the paste and comes to the surface of the bags. If the pressing be done hastily, as with hydraulic presses, the mass contracts instantaneously and the oil remains inclosed.

"It requires a strong but slow pressure to draw out all the oil from the olive; *strong*, to drive it out and free it from the albumen which



Samuel Rae & Co., Boston.

OLIVE OIL PRESS, WORKED BY STEAM PRESSURE OR HAND POWER.

retains it; *slow*, to give it the time necessary to go through the crumbs and leave the albumen."

Hydraulic presses, therefore, may be used at pleasure and to much advantage for the extraction of oil from the dregs, when they fill the office of presses of last compression, but never for the first or second extraction.

The other utensils belonging to the oil factory are the bench, the tub, the paste recipients, the vats, the bottles, the barrels, the jars or pots, etc.

The bench serves to receive the paste produced by the crusher, and to fill the paste bags. It is generally made of wood, and located in the same room with the crusher. It must be of such a size as to be able to contain all the paste from a whole charge or crushing, and allow besides for the filling of the paste receptacles. To prevent the wood, of which the surface of the bench is formed, from becoming saturated with oil, it is expedient and very useful to cover it with a sheet of tin, which not only prevents the absorption of oil on the part of the wood, but can be cleaned with great ease.

The tub is a recipient formed of wooden or iron staves; into it is put the paste as soon as it comes out of the crusher, whenever it is wanted to draw off the virgin oil. As the wood composing the tub presents the same inconvenience indicated for the bench, and in a much greater degree, since the paste remains in it for a longer time, it is useful to line it also with tin on the inside, so as to avoid the trouble and expense of changing tubs every time one wants to secure the virgin oil, or else subjecting it to repeated washings with lye and rinsings with vinegar.

In many places the tub is put into a reservoir located near the press, and used to receive directly the oil flowing therefrom. Whether or not the paste be subjected to the extraction of virgin oil, it is always put into the bench and thence into the paste recipients, to be afterwards subjected to the pressure of the oil press.

Of all the paste bags in use, the best ones are those made of rush, because the rush absorbs little or none of the oil and does not communicate any flavor to the liquid. But bags of this description are easily stopped up, on account of their peculiar texture, and last but a short time.

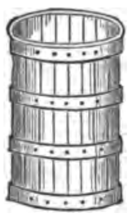


Fig. 13.

The most desirable paste recipients are the modern ones which accompany especially the iron presses. These recipients (see Fig. 13) are composed of perforated iron plates or of iron bands, set up at small intervals from each other, and kept in place by stout metal hoops, like those used in the pressing of wine.

The flowing out of the oil from the metal recipients is facilitated by inserting perforated boards or disks of rushes at short intervals throughout the paste. To the metal recipients is imputed the defect of getting

stopped easily, and hence preventing the escape of the oil if the holes in the plates are small, and of letting out the paste if these are too large. This defect is easily overcome by lining them with sackcloth on the inside. Thus arranged the metal recipients are to be preferred to all the others, for the reason that they cost less, are destroyed with much difficulty, need less repairs, and do not require during the pressing all the cares necessitated by the other paste receptacles. The oil flowing from the paste recipients is collected either in the tub or in the vats.

OIL VATS.

The vats may be likened to common, large-sized buckets, provided with two opposite prolonged staves having a hole in the upper end for the insertion of the index and middle finger, so as to facilitate their transportation. For the reasons mentioned above, iron recipients are to be preferred, or else wooden vats lined with tin on the inside. To avoid the repetition of the same things, I may say, once for all, that in the fabrication of oil one should avoid as much as possible the contact of either the paste or the oil with wood. Wood (excepting oak), owing to its porosity, becomes saturated with oil, and as the latter is sometimes of bad quality, it spoils the oils with which it subsequently comes into contact.

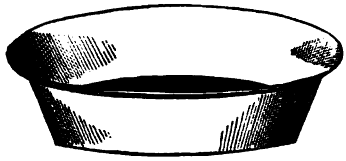


Fig. 14.

After the oil has been secured it is set at rest so as to make it clarify, and to this end are used glazed earthen vases or tin pans, rather wide and low. (See Fig. 14.) Their size is determined by the quantity of oil handled in the factory. The oil is taken out of the tub or of the vats with a small bowl or cup of wood, or better, of tin. A small bowl made of a gourd is also used. But besides the natural clarifying vessels, so to speak, the oil factory needs other clarifying utensils, called *filters*. Of filters there are many, but I will only mention the principal ones.

FILTERS

The filter most commonly used is formed of a vat with a double bottom, very large, and provided with conical holes, filled with carded cotton. The cotton is placed evenly, and not too compactly, as otherwise the oil could not go through. In order to prevent the filter from getting clogged up, it is usual to cover the bottom with a layer of tow, or else with several layers of straw. The apparatus for filtering, and which is mostly used, is constructed as follows:

A wooden box thirty-nine and one half inches long, and nearly two feet wide, and twenty-seven and one half inches deep, set upon four legs, and lined with tin both on the inside and outside. From the bottom of the box hang either six, eight, or twelve cylindrical tubes of tin, which are perforated. In these tubes is placed some carded cotton, to a thick-

ness of two and three quarters to three and one eighth inches, which is kept in place by a perforated disk, also of tin. Under the tubes there is a second recipient, likewise made of tin, destined to receive the oil flowing from the filter.

Another valuable filter is the one composed of a barrel carbonized inside and divided into two compartments by means of a diaphragm; in the upper compartment, and precisely on the diaphragm, is placed a layer of very coarse sand one finger in thickness; over this a layer of animal or vegetable charcoal about two feet high, and finally a third layer of coarse sand. In other words, the two feet of charcoal have to be inclosed between two layers of coarse sand. The oil is poured into the upper compartment, and comes out limpid into the lower compartment, from which it is drawn by means of some faucets, which may be located at different heights.

A good substitute for cotton in the filters is a layer of dried mosses, two to two and three eighths inches thick, placed under another layer of tow three quarters of an inch in depth.* A filter containing three layers, one of fine sand, one of charcoal, and another of chalk, is also used. It is asserted that such a filter purifies the oil well, because the sand retains the matters that are in suspension, the charcoal lightly discolors the oil, and the chalk absorbs the water it contains.

I have found very efficacious for the purification of the oil, a filter composed of two layers, one of animal charcoal in grain, washed, and the other of carded cotton.

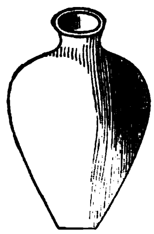


Fig. 15.

It is well to note that the cotton to be used in the filters should be soaked for twenty-four hours in water containing a solution of 1 per cent of caustic soda, and afterwards washed with pure water and dried. This precaution is necessary to prevent the cotton from imparting a bad taste to the oil.

VESSELS FOR PRESERVING THE OIL.

The oil having been purified, it has to be put away for preservation, and for this purpose are usually employed glazed earthen vessels, oval in form, somewhat distended in the body, more or less broad and high, of the capacity of about thirteen to one hundred and five gallons (Fig. 15). It sometimes happens that these jars break, and the oil contained therein is lost. To avoid this, many oil makers have them made of zinc or tin. Jars of this description are also preferable to the others, on account of being less porous and easier to close with padlocks, so as to prevent fraud on the part of the domestics. Some

* "L'olio di oliva," by Doctor Alessandro Bizzarri, Milan, 1875.

people use walled reservoirs, covered inside with slate. Reservoirs thus made are solid, but they are subject to the inconvenience of presenting too large a surface of contact to the air. Much better, therefore, is the system followed by some, which consists of inclosing the jars with a solid wall, so as to avoid breaking. Many tradesmen preserve their oils in cisterns or underground reservoirs made of stone, with inner walls of brick covered with cement plaster, or with sheets of lead or slate. The lead lining must be proscribed, for the reason that fresh oils easily attack and dissolve the lead oxides, which render them poisonous, and produce in the consumers that peculiar disease known under the name of "painters' colic," or *saturnina*. However, cisterns should never be used for the preservation of fine oils. In the cisterns may be placed the ordinary oils used in the manufacture of soap, for lubricating machinery, etc. The fine edible oils are to be preserved in rather small recipients of glazed clay, or better, of zinc or tin.

I believe it unnecessary to speak of the other utensils pertaining to the oil factory, such as the picks, shovels, lamps, etc., as they are all too well known. I will only remark that all the machines and tools used in oil making must be kept perfectly clean, as this has a marked influence upon the goodness of the oil. It is indispensable, therefore, that all the implements of the establishment be subjected to frequent washings with water containing 5 per cent of soda. Let frequent and copious washings be lavished upon the crushers, the presses, the mats, the tubs, the vats, etc., since their cleanliness contributes toward making the oil keep. All these practices are conformable to the assertion that any defects which may be disclosed in the oil a few months after its extraction are to be ascribed to the want of cleanliness.

The barrels and casks used for the transportation of the oil, which I have deemed superfluous to describe, as they are very well known, must also be kept clean, and they should be washed with a little vinegar, and then emptied before filling them with oil.

PRESERVATION OF THE OLIVES.

There is an old proverb which says: "Whoever mashes the olive fresh, mashes rightly;" which means that if the fruit from the tree be mashed as soon as picked, it brings more profit. Granting that some proverbs no longer apply after the lapse of a few centuries, the one just quoted will hold good forever, because fresh olives will always, and at all times, yield finer oils than preserved olives, whatever be the means of preservation employed. That the olives mashed fresh give the finest oil is beyond doubt; the ancients *knew* it, the moderns *know* it.

Cato* and Columella prescribed that the olives be pressed as soon as gathered in order to obtain good oil, and Palladius laid down as a rule, not to gather any more olives in one day than can be pressed during the following night.† Presta also advised to mash the olives immediately, and finally Caruso, Bechi, Basile, Cappi, Caponi, and others, to-day, agree in saying that olives put into the crusher as soon as taken off the tree furnish an oil of better quality.

With all this, however, it is painful to see how, in the greater part of

*Olea ubi lecta siet, oleam fiat continuo. Cato. (Let the oil be made as soon as the olive is picked.)

† Tantum legendum esse olivæ, quantum nocte ventente possimus esprimere. Pall.

the Italian oil-producing regions, is preserved always that most pernicious practice, acquired from time immemorial, of keeping the gathered olives piled up for a greater or lesser time, and afterwards putting them into the crusher to extract the oil.

The olives kept in a heap ferment and, as will be seen later on, the oil is spoiled, and is no longer fit for table use. It is hardly credible, but still it is true, that in some districts of southern Italy and Sicily the fermentation of the olives is protracted as much as four months, and when they are taken out of the respository to be subjected to the crusher, it is necessary to have recourse to the pick, because the olives lose their primitive form, and are reduced to an almost homogeneous mass, like manure. In certain regions of Sicily it is customary to add salt to the piled olives to purge them, as the Sicilians say, and in others, besides the salt, they place big stones on top of the mass in order that the effects of the purgation may be more pronounced.

Where the olives are heaped the mass of the olives have often been found almost filled with mold, which showed itself even on the surface, and emitted a fetid smell.

In the pernicious practice of having the olives ferment, or, as some people say, *heat* or *effervesce*, is to be found the reason why, in the greater part of the Italian oil-producing regions, and especially in the southern provinces and Sicily, the oil produced is of a greenish color, loathsome odor, and strong flavor, so much so that it cannot be used on the table.

In the Province of Bari, in Tuscany, and in Liguria, regions where fine oils are made, the fermentation of the olives is not practiced.

Before examining the causes for which the oil deteriorates in quality with the *heating* of the olives, I believe it necessary to search into the reasons which have induced the growers to subject the olives to such a heating.

Many are the reasons set forth to excuse this inconsiderate practice, but the principal ones are three in number, namely: the *feudal* system, the *farming* system, and the *false* belief that the fermented olives yield more oil than the fresh ones. The first cause has disappeared with the abolition of the feudal system, but for all that the practice engendered by it continues to subsist. In times gone by the Barons were the sole owners of the lands, and exercised over them the power of high lordship, and as they were invested with the right to condemn, absolve, set a price on one's head, they thus obliged their own vassals to have their olives mashed at the baronial mills by paying a certain compensation, usually in oil. The number of mills, therefore, was too limited and wholly insufficient for the oil industry, and hence was felt the need of resorting to the system of fermentation. In one of these baronial mills still in existence, I have found about twenty cellars for the preservation of olives, each of which is divided into various compartments so as to hold divers lots of olives. But if the obligation under which the horticulturists were to mash their olives at the baronial mill has fallen with the abolishment of the feudal system, the inconvenience of the restricted number of mills as compared with the yield of olives has not disappeared, and consequently the pernicious habit of having the fruit of the olive tree ferment has continued and still continues to subsist. However, this inconvenience may be easily overcome, and with a single effort of good will, since to-day, as we have seen, mills may be built for the small as well as for the large producers, the trade affording nowa-

days small, middling, and large crushers, small, middling, and large presses.

The second cause, that is to say, the farming system, has not only maintained, as Caruso asserts, but rather increased the practice of fermentation. In all the regions where the farming system exists, and especially in the districts of Messina and Milazzo, it is customary to consign to the lessee the olives hanging to the tree after having estimated their quantity by empirical rules. The farmer has to make the harvest, express the oil at his own expense, and remit to the owner the quantity fixed by the estimator; what is left over belongs to him. And as the metayer does not possess a mill, and is obliged to pay the expenses incident to the extraction of the oil, just referred to—expenses which are estimated according to the grinding—and as the grinding is charged for in proportion to the volume of olives, and not to the amount of oil, he naturally prefers the method of making the olives ferment, because by reducing the volume to two thirds, or down to one half, he succeeds in saving from one third to one half the expense.

The abolition of the farming system on the part of the proprietors would bring with it the abolishment of the fermentation, since it has been proved that the countryman is always anxious to turn his products into cash, he going so far as to gather some yet unripe.

But the principal and most powerful cause which makes the fermentation practice still rule, is the false belief that fermented olives give a larger proportion of oil. That this is the principal and most powerful cause is proved by the fact that the fermenting of the olives continues to subsist in spite of the disappearance of feudalism, and is still practiced to-day in the districts where the farming system is not in use. It is therefore necessary to instruct the oil makers concerning this error, so as to make them abandon a practice which is so injurious and so absurd.

Even the ancient writers on rural subjects have acknowledged that no increase of oil takes place in the fermented olives. Cato wrote that "one must not believe that the oil increases upon the floor; but that on the contrary, it diminishes, and becomes bad."* And Columella afterwards called this belief mendacious (*mendacium*), and wrote that "it is false that the oil increases on the floor, as much as it is false that grain increases on the thrashing floor." Presta, in his valuable treatise on the olives, relates new experiments made on this subject, and thinks he can infer that in the olives the oil increases a very little by means of fermentation and heat. Meloni, in his valuable articles on oil making, comes to the same conclusions as Presta. Caruso, on the other hand, shows clearly that the oil diminishes rather than increases in the fermented olives.

Two grave evils therefore arise from this treatment, the deteriorated quality and the lessened quantity of the oil.†

Filippo Bacile, in a valuable treatise,‡ related rather at length the various opinions entertained in regard to the proportion of oil in the fermented olives, and concludes that the latter do not yield a larger quantity of oil. He also adds that from the results of his own experiments he had to be convinced that the oil from unfermented olives set

* Cato de re rusrica.
† Caruso. Work cited, p. 119.
‡ Baron Filippo Bacile, Lecce, 1873.

at rest deposits very little sediment; whereas, the oil from fermented olives drop and abandon nearly one half of sediment, and, moreover, becomes in time detestable. Bacile notes further that if the oil extracted from fermented olives be sold before it is clarified, to avoid part of the loss due to the heavy deposit it makes, it brings a much lower price. Admitting now, what is not true, that fermented olives give a little more oil, what price can it command?

Professor Bechi, of Florence, made, a few years since, some experiments upon fermented olives, which are worth relating in full: "Upon the return of the Agricultural Association of Florence" (it is Bechi who speaks), "Mr. Taruffi raised the question as to whether the quantity of oil increased or diminished in the olives that are kept in store for some time, as compared with the quantity of oil yielded by fresh gathered olives. The question appeared of great importance to me, and I therefore undertook a series of experiments, the results of which I now deem it my duty to make known.

"The first experiments were begun on the eighteenth of December, 1875. The olives were at that time gathered from the tree. The mean density of each olive was $16\frac{1}{20}$ grains, the mean weight $26\frac{3}{4}$ grains, and they gave 19 per cent of oil. Olives kept until the eighteenth of February, 1876, and treated in the same manner, gave four and two thirds more oil as compared with the fresh ones.

"On the thirteenth of December, 1876, I again picked olives from a tree, and mashed part of them fresh, while the rest were put away to be tried later on. It must be said that the mean density of each olive was $15\frac{37}{50}$ grains, and the mean weight $43\frac{1}{2}$ grains; and I secured 18.036 per cent of oil.

"On the twenty-first of February, 1877, I extracted the oil from the olives that had been kept over, and comparing the oil obtained with that yielded by the fresh olives, there would have been a loss of about $4\frac{1}{2}$ grains per hundred grams.

"On the twenty-fourth of October, 1877, I repeated the experiments, and gathered the olives from an olive tree. They were invariably green, hardly beginning to turn black. The mean density of each olive was $33\frac{1}{3}$ grains and the mean weight $28\frac{6}{25}$ grains. These olives gave 17 per cent of oil. Part of them, however, were preserved until the twenty-third of November; they then had all become black and seemed well ripe. Being mashed they gave me three and one third more than what I had secured on the twenty-fourth of October.

"On the eighteenth of December I had gathered the olives which had been left on the same tree, and which were quite black and very ripe. Each olive weighed on the average $25\frac{11}{25}$ grains, and had a density of twenty grains. From these olives I got 24.32 per cent of oil.

"On the third of January, 1878, I pressed a portion of the olives which had been kept over, and having compared the oil with that given me by the fresh olives, I found an increase of 1 per cent.

"On the twenty-second of January another portion of these same olives that had been kept over was pressed. They were exceedingly withered. From such olives I received 6 per cent less oil than from the fresh ones.

"From the results of these experiments, it seems to me that one may conclude that olives gathered green gain in oil by keeping them over for a few days before putting them into the crusher; that olives already

ripe do not lose oil if left on the floor for some days, but rather increase their yield a very small quantity; but that a great loss of oil ensues from their being left to wither a long time."

There now remains only for me to relate the results of an experiment which I made, with the same intent, in the course of the year 1880, a year in which there was a full crop.

On the first of December I took about forty-four pounds of olives, half of which were pressed immediately, giving:

	lbs.	oz.
Oil	4	3
Residue	8	0
Water	9	13
Total	22	00

And the other half was stored to be pressed later. And, in order to put the olives into conditions perfectly identical with those which they are usually subjected to during fermentation, I inclosed them in a small net and put them into a cellar together with a large quantity of olives. On the first of January, 1881, that is to say, one month afterwards, I took out the olives stored in the cellar, and found they had lessened in size and weight; they weighed but sixteen pounds and twelve ounces. I extracted the oil and had:

	lbs.	oz.
Oil	3	12
Residue	6	2
Water	6	14
Total	16	12

Pausing now, for a moment, over the experiment of Caruso and over mine, it will be found that the four hundred and twenty-five pounds of fresh olives gave to Caruso:

	lbs.	oz.
Oil	78	9
Residue	167	15
Water	178	8
Total	425	00

That is:

Oil	18.50 per cent.
Residue	39.50 per cent.
Water	42.00 per cent.

And that the one thousand two hundred and seventy-seven pounds and five ounces, fermented for thirty days, gave him:

	lbs.	oz.
Oil	209	15
Residue	335	12
Water	356	13
Total	902	8

With a loss of three hundred and seventy-two pounds four ounces, and hence he had:

Oil	16.46 per cent.
Residue	26.45 per cent.
Water	27.98 per cent.
Loss	29.11 per cent.

The twenty-two pounds of olives which I pressed fresh gave me:

Oil	19.10 per cent.
Residue	36.50 per cent.
Water	44.40 per cent.

And the twenty-two pounds pressed after thirty days yielded:

Oil	17.20 per cent.
Residue	28.00 per cent.
Water	30.80 per cent.
Loss	24.00 per cent.

Thus, far from increasing the oil with the fermentation, the olives decrease it; and, indeed, Caruso obtained 18.50 per cent of oil from the fresh olives, and only 16.46 per cent from the fermented ones; these, therefore, yielded 2.04 per cent less of oil. If we compare the olives that is the loss, and 11.02 per cent if we compare the oil. I had 19.10 per cent of oil from the fresh olives, and 17.20 per cent from the fermented ones; consequently, the fermented olives sustained a loss of oil of 1.90 per cent as compared with the other olives, and of 9.95 per cent as compared with the oil which they would have yielded fresh.

The experiments of Caruso and myself must have a practical value, superior to that of the other experiments, since the preserved olives were put into the identical conditions under which they are usually found when preserved in cellars. And if some experimenter has been able to obtain from olives stored for some time a little more oil than was given by fresh olives, it is because he did not subject them to the true fermentation which they commonly undergo in the cellar, but to a simple desiccation.

It occurs to me here to point out another fact, and it is this: If the oil obtained from the fermented olives, instead of being compared with the original weight of the olives when put away, be compared with the weight they have at the time they are taken out of the crusher, the larger proportion of oil in the fermented olives appears real. And, in fact, if we compare the two hundred and nine pounds fifteen ounces of oil obtained by Caruso from the fermented olives with the nine hundred and two pounds eight ounces they weighed at the time they were taken out of the cellar, and not with the one thousand two hundred and seventy-seven pounds five ounces weight they had before being stored, the proportion of oil will amount to 23.25 per cent, with an apparent gain of 4.75 per cent, or a little more, over the 18.50 per cent yielded by the fresh olives. Similarly, if the three pounds twelve ounces of oil, which I obtained from the fermented olives, were compared with the sixteen pounds twelve ounces, and not with the twenty-two pounds, the proportion would amount to 22.63 per cent, with an apparent gain of 3.53 per cent over the 19.10 per cent secured from the fresh olives.

And this is the error which induces horticulturists to hold that fermented olives give a larger proportion of oil. Columella, therefore, justly said that the countryman forgetful of the first measurement of the olives at the time they are gathered and put away, observes only that which they have when taken out and sent to the mill, not reflecting that the olive shrivels and becomes smaller on the floor, and hence as everybody sees that it requires one third or one fourth the number more to make heaped measures, and that one has to make up by additional olives what is wanting to each measure.

From what has been said above, it seems to me that one may reasonably conclude that it is an error to hold that fermented olives give a larger proportion of oil, and that, on the contrary, they lose some. The loss may probably be accounted for by the separation of the mesocarp, by a partial dissolution of the oil into its elements, and finally, also, by means of the evaporation of the water. As the water evaporates, owing to the heating of the olives, it may carry away mechanioally a small quantity of oil with which it finds itself in contact. It is not impossible that to this dispersion is added another of a wholly chemical nature, as pointed out by Caruso, namely, that part of the azotic substance, besides coagulating under the action of the heat, develops ammonia, a very powerful alkali, sufficiently to combine with a small quantity of oil and turn it into soap. The soap is recognized, inasmuch as it is soluble in water. But supposing, though it is not conceded, that with fermentation the olives gain a little in oil instead of losing, would it be expedient to sacrifice the good quality of the oil for a worthless increase in quantity, inasmuch as it is to be hoped no one will contend that the oil extracted from fermented olives is of good quality?

The oils secured from fermented olives are always strong-tasted and rancid, and I do not believe any one can be found who would be willing to exchange two hundred and twenty pounds, for instance, of fine oil, for two hundred and twenty-five, or even two hundred and thirty pounds of fetid oil.

It will not be superfluous to consider for what reason the oil is spoiled in the cells of olives subjected to fermentation. The olive, as every other fruit, or, better, as every organic subject of whatever nature, is subject to alterations and decompositions, which are developed always to the detriment of its component parts. And whatever be the cause of the alterations and decompositions, it is beyond question that their action will be more or less pronounced, according as the olive will remain more or less exposed to the air. The want of serious studies over an edible substance of such great importance makes it impossible to determine with true exactness the causes of the alterations of the oil in the olives, and of what nature these alterations are, and they may be ascertained only by way of conjecture. Bechi assigns to the olives the following elementary composing parts:

	In the Pulp.	In the Stone.	In the Kernel.
Carbon	65.40	35.30	60.34
Hydrogen	10.20	6.20	9.65
Azote	1.88	1.57	2.98
Oxygen	19.24	43.56	24.43
Ashes	3.28	2.37	3.00
	100.00	100.00	100.00

The conditions indispensable to the accomplishment of the alterations indicated are humidity, heat, ferment, or some other thing of similar nature, and if a single one of them be lacking, the fermentation no longer takes place.

Heat is sufficiently developed when the olives are placed in a heap. Presta asserts that he found a cellar containing olives where the temperature had risen to 34 degrees Centigrade, and Rozier is of the opinion

that it may reach 45 degrees. Bianchedi, the engineer, found, also, a place with 45 degrees. Humidity, on the other hand, cannot be wanting, since, not to mention that the cellars where olives are preserved are usually very damp, the heaped olives continually emit moisture through evaporation, as is proved by the diminution of volume and weight they undergo. Neither can be wanting the third and last condition, that is to say, the presence of ferment, since air is not lacking in the cellars. Thus, with the concurrence of all the circumstances required for the fermentation, and hence for the alteration of some of the constituent principles of the olives, the oil must be altered and modified in such a manner as to render it disgusting. This fermentative action of the composing principles of the olives is sufficient to ruin the oil, since with that action is developed a rather high temperature, owing to which the oil becomes rancid, for, as we all know, one of the most effective causes of the rancidity of the oil is excessive heat.

Practice and science have ascertained that under favorable conditions of temperature the oil absorbs oxygen from the air, thickens, and becomes rancid. Whether the oxygen acts by its own virtue, as Liebig contends, or through the medium of the fermenting principles with which the air is loaded, as is maintained by Pasteur, it is not the province of the present work to determine; it is sufficient simply to know that the oxygen of the air renders the oil rancid.

There might exist yet many other causes, besides those indicated, which contribute to the ruin of the oil in the fermented olives, and it is to be hoped that in the future chemists will pay a little more attention to the precious fatty liquid, in order to disclose all those facts which lie in mystery.

It seems to me an established fact, therefore, that olives heaped up in cellars and kept there for a certain time, ferment, and that the fermentation produces alterations in the oil. The oil is not like the juice of the grape, which requires a second chemical process to transform its sugar into alcohol and become wine; the oil is found nice and all prepared in the fruit, and the best that can be done is to extract it just as it is, by breaking the cells which contain it by means of trituration, and pressing afterwards the paste resulting from the trituration.

Having ascertained that the olives heaped up in cellars give a smaller quantity and a lower grade of oil, it would be foolishness to keep up the practice of the fermentation, and it is expedient, therefore, that it be abolished, and forever.

I have thought it necessary to devote rather a large space to the preservation of the olives, because it constitutes the basis of oil making; the good quality of the oil depends mainly upon the state of the olives.

MODE OF WORKING THE OLIVES AND COLLECTING THE OIL.

Before describing the mode in which the olives must be crushed in practice, to be subjected afterwards to the action of the press, I deem it useful to make a classification of the oils.

The oils have been classified in several ways, and their classification is based always upon the particular manner in which the olives are worked. Here is how olive oils are classified:

First—Virgin oil.

Second—Oil expressed from the paste without water.

Third—Oil expressed with the aid of hot water.

Fourth—Oil of the second vat washed out with either hot or cold water, according to the season.

Fifth—Oil from reground paste.

Sixth—Oil from the residue pit.

Seventh—Washed oil.

The virgin oil, which might be called also superfine oil, is generally drawn from the paste without any pression whatever.

Oil expressed from the paste without any water is also a fine oil, and is obtained from paste subjected to the first pressure, it being put into a vat or tub as soon as pressed out.

The fine oil having been secured, the pile of bags is washed with hot or cold water, according to the season, in order to collect the small quantity of oil sticking to them, which is set apart, and constitutes the oil of the second vat.

It frequently happens in cold weather that the paste will not yield the oil unless it be washed out with hot water; otherwise the liquid would remain mixed with the dregs and water, and consequently would go for the most part with the washed oils; oil thus obtained is called "oil expressed with the aid of hot water."

The paste is then taken out of the press, treated with hot water, reground, and put again into the press, but the oil obtained is good only for soap making, for lubricating machinery, etc., and is called "oil from reground paste."

In some places the paste is ground for a third time, pressed, and made to yield still another quantity of oil. The third grinding of the paste is not practiced, however, in establishments where the dregs are passed through an agitator.

Lastly, the washed oils are those secured from the dregs by subjecting them to repeated washings, as will be seen a little later. This being premised, we can pass to the working of the olives.

Olive oil is found in cells, bright and ready made, and to obtain it one has only to mash the olives, and afterwards press them so as to make it come out with the water of vegetation, from which it separates by virtue of its specific gravity, since oil is to water as 913 to 1,000.

Thus, to secure the oil it is only necessary to mash and press the olives. However, with the olives are also triturated their tissues, the particles of which come out mixed with the oil and the water, and though they be of greater specific gravity than the oil they do not separate completely at first; hence, many particles naturally remain mixed with the oil, as also globules of oil remain imprisoned in the water of vegetation, and are carried to the bottom. This is proved by the fact that when the dregs and waters of vegetation are allowed to rest in reservoirs they become covered at the surface, after a certain time, with a thin layer of oil, which is collected, but is oil of very inferior quality.

Were all the oil separated at once from the water of vegetation, and from the particles of tissue, one crushing and one pression would be sufficient to draw it out completely, but this not being the case, it becomes necessary to practice a series of operations in order to be able to secure, if not all, at least the greatest part of the oil obtainable from the olives.

The first operation which the olives must be subjected to is the crushing. The fruits are carried to the crusher clean and freed from foreign

matters, and the charge varies according to the kind of crusher employed.

In crushers commonly used, the charge is about six bushels of olives, which weigh from three hundred to three hundred and fifty pounds. The charge may be increased to four hundred and fifty pounds of olives and over in crushers with two stones, to six hundred and fifty pounds in crushers with three stones, and it may go as high as nine hundred pounds in crushers with four stones. Whatever be the crusher used, it is essential to mash the olives in such a manner as to reduce them to a homogeneous paste. This requires a variable time, generally from half an hour to an hour. If it be desired, however, to obtain the superfine oil, called *virgin*, the crushing must not be completed, but only half done, so that the olives will be only half crushed, and in this way will be secured the finest oil that can be made. The degree of fineness of the paste from the olives depends, in hand-crushers, upon the relative distance of the cylinders from each other. In crushers provided with stones, it depends instead upon the number of revolutions of the stones and the skill of the operator.

It happens sometimes that the olives are rich in pulp and very watery and then escape easily from under the stone. In that case the paste becomes watery and lacks homogeneity, and when afterwards it is put into the bags some of the watery part runs out and occasions a loss of oil, which is carried away by the water. To obviate this some people advise to mix with the olives a small quantity of straw, which, getting mixed with the paste, facilitates its thorough grinding and prevents any loss of the liquid part, and hence of oil. The use of oil grounds instead of straw is advised, the same to be mixed in the proportion of thirty-five to forty quarts to every six or seven bushels of olives. Oil grounds are preferable to straw, since, as they absorb the superflous humidity of the paste issuing from the first grinding of the olives, the oil flows out purer and more easily. Moreover, by using oil grounds one saves expense and avoids the danger of giving the oil some disagreeable flavor; not to mention that the oil which is absorbed by the grounds may be recovered afterwards by subjecting them to the action of the agitator.

After a certain time, varying from half an hour to an hour, according to the perfection of the crusher, the olives are reduced to paste and ready for the press. If the crushing has been only half done, in order to obtain the virgin oil, the paste is then taken out of the mortar and put into a tub, where a small but rather deep trench is formed into it for the purpose of collecting the oil, which runs out without pressure. This oil is skimmed off with small and nearly flat ladles, provided with a curved handle, and it is the *virgin, or superfine oil.*

Virgin oil thus extracted is very rare and hardly ever made, either because it requires much care, time, and patience, or because it deflowers the oil remaining in the paste. There are people who find the virgin oil of little value and rather fat, but this defect may be easily obviated by filtering the liquid, as will be explained further on.

In order to have virgin oil one must, besides following the directions already indicated, maintain an almost exaggerated cleanliness in all the utensils, because without it the requisite excellence cannot be attained. As a matter of fact, it is customary with manufacturers of virgin oil to change tubs at every extraction of the liquid, as they hold that no mat-

ter how well the tubs are washed they do not possess the desired cleanliness.

The virgin oil having been collected, the paste is put into bags within the tub itself, and then subjected to the action of the press. But if the extraction of the virgin oil is not practiced in the manner indicated, or else it is not desired to collect it, the paste is passed from the mortar to a table and there put directly into the bags. In the southern provinces, where the common crushers are used, the filling of the bags is done in the mortar. This would be impossible with the crushers provided with troughs.

In many parts of France they sprinkle over the paste, before putting it into the bags, a certain quantity of good vinegar, which facilitates the flowing out of the oil and makes it come out in larger quantity. This practice is not to be despised, for, as the vinegar acts upon the mucilaginous matter, it separates it from the oil, which, being free, flows out in larger quantity, of better quality, and without any defect whatever.

The filling of the bags is an operation which requires much skill on the part of the operator. These bags must not be too full nor insufficiently filled, because, when under the press, they would not only let out the oil but also the batter which keeps the oil imprisoned. This work, therefore, should be assigned to skilled workmen.

The bag to be filled is set up vertically upon the bench and pressed from above with the left hand, so as to spread apart the two disks composing it, and have it present its mouth open towards the paste. As much paste as is deemed sufficient to fill it is then thrown into it with the right hand, after which it is set in a horizontal position. Grasping now the upper disk by the edge with his left hand, to keep it raised, the operator thrusts his right through the aperture and spreads out the paste evenly, beating it down a little. This being done, the bag is well stopped up with as much pressed paste as can be squeezed into its mouth, and it is carried to the press.

Even the disposition of the bags under the press requires skill on the part of the operator. The "tower" or "castle," as is commonly called the stack of paste bags piled upon the platform of the press, must be perfectly vertical, so that an even pressure may be exercised over the whole mass, a condition indispensable to obtain the greatest quantity of oil from the paste.

The number of bags to be piled upon the platform of the press is variable, and depends upon the size and power of the press. It usually runs from twelve to twenty.

Between each bag a metal disk is interposed of a somewhat smaller diameter than that of the bags. The metal disk inserted between the bags not only renders the action of the press more effective and regular, but prevents the oil, which flows out of a bag from above, from being absorbed by the paste below, and, on the contrary, leads the oil down the pile to the platform.

Most of the work just described is avoided by the use of the cylindrical recipients made of perforated iron plates, or of iron bands, held at short distances apart. To fill these recipients it is merely necessary to pour the paste into them a little at a time, level it, and insert at various points through it a few diaphragms or circular disks made of common wood. The recipients, however, should be lined first with

some sackcloth, so as to prevent the paste from running out under the pressure.

The paste bags having been piled upon the platform of the press, or else the iron recipients put into position upon it, they are capped with a portable wooden disk and two or four blocks, and then allowed to rest for a little while so as to permit the free flow of the oil, which comes out first under the light pressure exercised by the paste itself, by the wooden disk, and by the blocks. This oil is gathered separately, and it is the *virgin oil*. This stoppage, and this separation, are done away with if the extraction of the virgin oil has been effected previously in the tub, or if it is not desired to make any in order not to deflower all the rest. This being accomplished the pressure is brought on gradually, while at the same time an attendant guides the tower with his hands, in order that the descent of the screw of the press may not derange the paste bags in any way. If the bags have not been placed in order, and the "castle" is out of equilibrium, it is expedient then to take them down, and build the pile anew with greater attention.

The pressure at first must not only be slow, but it should be stopped once in awhile to give time to the pile to settle and to the oil to flow out of the pile. In presses with a simple lever the screw is first lowered by hand, and when the force of one man is no longer sufficient to move it a short pause is made. The short bar is used next, not forgetting to stop a little at every four or five turns of the bar. When the latter becomes unable to lower the screw any more, recourse is had to a lever nine or ten feet long, which is operated by hand at the beginning, but subsequently with the capstan. Even while the long lever is used one must not neglect to rest a few minutes after every three or four turns. In presses with a compound lever, the short bar is employed first and then the long lever, still bearing in mind the oft-repeated warning in regard to stoppages, in order to give the oil time to flow, or, as people usually say, to give the paste time to "digest." With these presses, however, the stops may be shorter, for the reason that the pressure of the compound lever is uniform and slow. The oil flowing out is collected in a tank, which is generally situated in a reservoir dug in the ground underneath the press, or else in large tubs, if the press is placed a little above the ground, and there is no reservoir. If the tubs be used, these must never be filled to the brim, but as soon as they are filled up to within one and one quarter to one and one half inches from the top they should be replaced by empty ones.

The oil obtained by this first working, and which we have called "oil expressed from the paste without water," is a fine oil, and it has been also designated by the name of "oil of the first pressure."

As soon as the pressure is completed, and no more oil flows from the platform, the pile of bags is washed with cold water, if the weather be warm, or vice versa, in order to secure the oil sticking to it. This oil is collected in a separate vat, as it is of lower grade than the first, and it is the one we have indicated by the name of "oil of the second vat washed out with water."

Should the olives be treated in the manner above described, when the season is unusually cold, the oil obtained by the first pressure would remain mixed for too long a time with the water of vegetation and the grounds, and consequently a great deal of it would go with the washed oils, and those of very inferior quality.

To avoid this it is usual with many to wash the paste with boiling water before subjecting it to pressure. The boiling water, through which heat is communicated to the paste, coagulates the albuminoid matters and frees the oil, which flows out easily. Boiling water is to be preferred, as cold water would be of no avail, and lukewarm water would impart to the oil a taste of smoke. The oil obtained from paste treated in this manner is called "oil expressed with the aid of hot water," and is inferior in quality to that yielded by paste not subjected to such a treatment, because hot water gives the oil a greenish color, and injures its flavor. Notwithstanding this, it is necessary in cold years to employ the means described, in order to have a larger quantity of oil. But for him who wants to make fine oils, let him be satisfied with spending a little more time and more labor in pressing the paste, and banish the boiling water. Its use is pardonable only in pastes giving oils of second or third quality, oils which as a rule are not employed as a condiment for food.

The oil having ceased to flow, the screw is raised and the paste bags are emptied into the mortar, so that the paste may be subjected to a second crushing. It is the general practice then, in order to facilitate the second mashing, and hence the flow of the oil which still adheres to the albuminoid matters, to pour on the paste some boiling water, which coagulates these matters, and makes the oil flow down the pile (of bags) with greater ease. But the evil effects of boiling water have just now been pointed out; this is why I prefer the recommendation of Caruso, which is to mix with the paste to be reground a few sliced lemons, or else a cold solution of tannin, or even a certain quantity of vinegar, as practiced by the French. The citric, tannic, and acetic acids coagulate the albuminous matters as well as the boiling water, without giving rise to the disagreeable effects produced by the latter.

The lemon, the solution of tannin, and the vinegar, are to be preferred also for the sake of economy, as their use involves but a trifle expense; and among them the most economical is the tannin solution.

The solution of tannin is prepared by steeping ground oak or maple bark in water for two or three days. Understand from this how economical its use is, and that it should be substituted for boiling water, which ought to be strictly excluded from the treatment of the oils.

The paste having been ground for the second time, it is put into the recipients once more and subjected to the action of the press, care being taken to follow the same directions given for the first pressure. The oil obtained therefrom is called "oil from reground paste," "oil of the second crushing," etc., and though it is somewhat inferior in quality to the first, it is still good.

In many places the paste is ground for a third time, after the second pressure, and then is secured the "oil of the grounds." It is much better though to omit this operation and subject the grounds to the action of the agitator, as will be seen later.

For the mills where the agitator is not used, the third crushing is excusable to a certain degree, although the oil secured thereby hardly repays the expense of extraction; but for the establishments in which the grounds are passed through an agitator, it would be a useless expense.

It seems to follow, from what has been said up to the present time, that one should employ three presses with each crusher, in order to be

able to perform the work quickly and without interruption. If only one press were run in connection with each crusher, the latter would do but little work, since the paste has to stay under the press, at each operation, for a time at least treble that which it takes to go through the crusher. Thus, while the press would be working all day, the crusher would work one third of the time only. In many oil mills I have seen two presses assigned to each crusher, and there, also, I have seen the crusher remain idle for a good part of the day.

We have now seen how to work the olives and treat the paste in order to obtain the oil, but with the latter come out many foreign matters, and especially the water of vegetation, which is more abundant than the oil itself; it is therefore necessary to say a few words concerning the mode of separating the oil from these foreign matters, or rather the mode of collecting it.

COLLECTING THE OIL.

To collect the oil from the tubs or the tank in the underground reservoir seems an easy task at first sight; however, it requires a certain dexterity and ability in the person who performs it; a dexterity and ability which it is difficult to teach by words, and still more by writing. I shall therefore confine myself to saying a few words upon the subject.

As soon as the oil separates itself from the substances with which it issued from the "tower," and it comes up to the surface of the water of vegetation, owing to its lighter weight, a trained workman collects it with a wooden or tin ladle and pours it into another recipient, stopping at intervals to give it time to rise. Whenever it is perceived that the water is nearly reached, which is indicated by the dark color presented, the operator lays aside his ladle and uses instead a lighter and nearly flat utensil, with which he slowly and very carefully skims off the surface of the liquid until the last drop of oil floating thereon has been collected.

Whatever be the skill of the operator there always remains some oil in the liquid, and hence it is usual to resort to various means in order to secure the most of it. Some people skim the surface of the liquid with dried panicles of marsh-reed, or else with cotton, or even a sponge; others, instead, wash out the residues with boiling water. However, there always remains some oil imprisoned in the water of vegetation and the other matters mixed with it, and it is not advisable, therefore, to throw away, as many oil makers inconsiderately do, these residues, which are designated by the name of grounds, dregs, lees, etc., but it is expedient to put them together in a ground reservoir, so that the oil may liberate itself in time and come to the surface, when it can be collected.

The oil having been collected, it is carried to the clarifying-room, where it is subjected to a few operations which will be indicated in the chapter devoted to clarification. In the meantime, it is well to point out that the different oils obtained from olives subjected to different operations must be kept separate, because by mixing them the good oils always lose in quality, while the poor ones do not gain in any wise. The blending of oils is not expedient, though the blending of wines may be in certain cases.

The residual grounds still contain oil, and as soon as they are taken out of the recipients, after the second or even the third pressure, they

are usually put into baskets and piled in large trenches, where they require a great deal of care, as will be shown when explaining the treatment of the grounds, to which is devoted the following chapter.

I will not close this article on the mode of working the olives and collecting the oil without giving a last warning in regard to the cleanliness of the utensils employed in the oil factory. The cleanliness of all the implements and machines is an indispensable condition for obtaining fine oils, favoring as it does their purity, their quality, and their preservation.

Oil makers must never weary of subjecting all the utensils which come into contact with the olive paste and oil, to free and frequent washings, using for that purpose water containing from 2 to 5 per cent of soda in solution. As to the recipients in which the oil is carried, it is better to rinse them with a glassful of vinegar every time they are used. Finally, one must avoid burning in the factory any substance which might emit any bad smell.

Let the oil makers bear in mind that olive oil is a very delicate liquid, which can easily acquire a disgusting flavor, and, therefore, that the cleanliness of the oil factory, tools, machines, and utensils can never be carried to excess.

MODES OF WORKING THE OIL GROUNDS.

The grounds are the residue of the paste which has already furnished oil, and they are for the most part used as fuel and as food for hogs, because people do not stop to reflect that they still contain oil, and in considerable quantity, as is evidenced by the ease with which they take fire, and the bright flame they emit—an oil which, if it cannot be utilized for cooking, may be employed for burning, and for lubricating machinery.

The difficulty presented by the old methods of treating the grounds, and their want of convenience, have not been favorable to their introduction; to-day, however, the extraction of the oil from the grounds has become an industrial operation of some importance, as the means now employed insure the desired object. There are in Italy some establishments equipped for the express purpose of working not only the grounds which may be bought in the home market, but also grounds imported from Turkey and Greece. All this proves that they bring positive profits. It is expedient, therefore, to occupy ourselves, though briefly, with their treatment. The methods followed, and which deserve to be taken into consideration, are three in number, namely:

First—The method of the agitator, or of the washed oil.

Second—The chemical method, or that of the bisulphide of carbon.

Third—The method of steam combined with pressure.

The paste recipients having been emptied into baskets, the grounds are put into large pits dug in the ground to a depth of about ten or twelve feet, so as to save them from the action of the sun, which would dissipate a little of the oil. The sides of the pits should be walled up and the bottom left unpaved, or else covered with a rough pavement, so as to leave it permeable. An impermeable bottom would cause the lower stratum of the grounds to rot. The pits, besides, must be covered with a roof made of branches, or else bulrushes, or even lath-work; thus, while the grounds are protected from the heavy rains and the solar rays, they

are not deprived of the circulation of air, and hence do not run the risk of becoming moldy.

The grounds are thrown into these pits a little at a time, each layer being heavily trampled down. Some advise to pour into them, every week thereafter, as much water as is necessary to keep the mass cool, as it is claimed that it will not then enter into a too active fermentation, which would impart to the grounds a blackish and almost burnt color, and spoil most of the oil.

The compressed and wet grounds yield less oil than grounds that have been simply compressed. A lot of oil grounds were divided into two equal parts, one of which was wet and compressed, and the other was compressed without wetting. At the end of seventeen months 2.30 per cent of oil was obtained from the first, and 4.52 per cent from the second.

They might yet be preserved heaped up in a state of powder, but they then yield less oil than the compressed grounds. From grounds in powder 4.19 per cent of oil was had, and from compressed grounds 8.71 per cent.

The first method of working the grounds, which has been indicated by the name of the agitator method, is very much employed. It is also called "method of the washed oil," and the oil obtained through it is known under the name of "washed oil," as it is secured by subjecting the grounds to repeated washings with water. The washing of the grounds is, however, a difficult operation, and it requires more than ordinary intelligence in those who undertake it and in the laborers who perform the work. Furthermore, it is necessary that the establishment be situated close to a source of water, which is indispensable for the washing of the grounds.

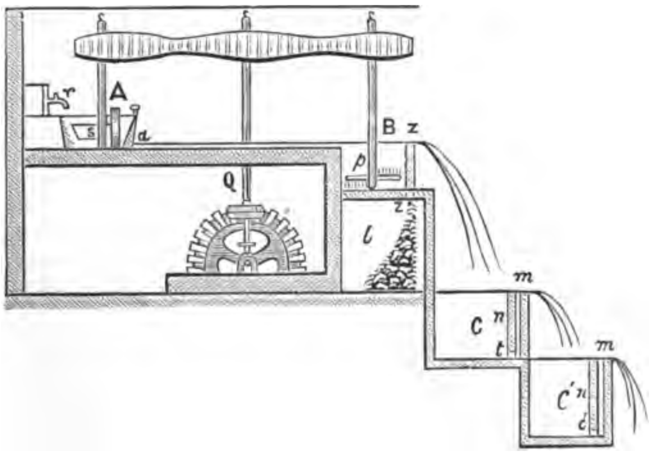


Fig. 15½.

The apparatus for washing the grounds must comprise a crusher with one or two stones and a set of basins or troughs. At *A*, Fig. 15½, we have a common crusher with trough, having at *a* an aperture with a small gate and a trapezium, *s*, in the vertical axis to stir up the paste. Over the mortar is a faucet, *r*, through which water may be poured continually into it. At *B* is a trough whose upper edge is lower than the bottom of the mortar of the crusher, and in the middle of which rises an axis pro-

vided at the base with a double comb, *p*, which serves to stir the paste. This apparatus constitutes properly the agitator. The trough just mentioned has in the bottom an aperture, *z*, provided with a small gate, and near the top another smaller aperture, *z*, furnished also with a small gate. The first aperture opens into the reservoir, *l*, underneath, and the second serves to convey the water to the basin, *C*. This latter, in turn, opens into the basin or trough, *C'*, and so on.

Each trough, as the reader will perceive, has an aperture, *t*, near the bottom, which communicates with a small vertical channel, *n*, formed in the edge of the wall after the manner of a siphon, and which goes through the thickness of the wall at *m*, a little below the upper edge of the mortar, and communicates with the next trough beneath. The crusher and agitator are put in motion by the shaft, *Q*.

The apparatus having been described, we shall now mention how it is operated.

The mortar is charged by degrees with about eight or twelve bushels of grounds, according to the size of the crusher and the number of troughs, and the stone is set in motion. The first portions of grounds are crushed in a dry state, and then the water is turned on so as to dilute the mass and separate the skins from the stones by virtue of the different specific gravity possessed by these substances. After three quarters of an hour the trituration and dilution of the grounds are complete, and the gate of the mortar is opened to allow the batter to run into the agitator, which is in turn put in motion, and by means of the combs and the copious supply of water soon separates the skins from the stones, the former rising to the top, and the latter falling to the bottom. This separation having been completely effected, which is indicated by the white color assumed by the stone, the gate at the edge of the agitator is opened and the water let into the trough below, into which it brings the floating skins and the oil. The skins go first to the bottom, owing to the fall, but they soon again rise to the top. And as the stream of water is continuous, and not only keeps the first trough or agitator always filled, but constantly flows into the troughs below to the same level as in the first, the heavy part—that is to say, the washed stones—remains in the first basin, and the rest is brought into the basins underneath.

The operation is finished when the water issues almost clear from the trough of the agitator. The lower gate of that trough is then opened, and the stones allowed to fall beneath, and the skins are gathered in the basins.

The washing furnishes two substances, viz.: oil and the skins, or pellicles, of the olives, which gather in the basins below the agitator. The oil is easily collected by transferring it from the last trough through a small channel to a settling tank near by, where it is afterwards separated from the water by means of the usual skimmer.

The skins, or pellicles, floating upon the surface of the liquid are collected with pans with perforated bottoms, or with baskets provided with a long handle, and then subjected to the press.

The pellicles may be pressed either cold or hot. In the first case they are put as soon as collected into baskets of peculiar texture and subjected to a first pression, after which the baskets are placed in cages and set under the most powerful presses. In the second case the skins are digested for about six hours in kettles filled with boiling water, before

being subjected to pressure. The oil which comes to the surface is collected with the skimmer, and the skins are gathered anew, put into the baskets and subjected to pressure as in the first case. To secure a greater quantity of oil, it is well to insert some metal disks at various points throughout the cages.

The cold system gives better oil, but a lesser quantity than the hot system. It may be stated, generally, that with the system of the agitator one succeeds in collecting from 2 to 4 per cent of oil from the grounds. Fresh grounds give more oil than old ones.

The process of extracting the oil from the grounds by means of bisulphide of carbon is no less in use than the agitator method. This substance is now very well known, at least by name. It is liquid at the ordinary temperature, without color, and emits a nauseating odor, similar to that of decayed cabbage. It boils at 46 degrees Centigrade, and takes fire very easily when exposed to the air, and therefore it must be handled with great care. It serves different uses. It is employed with success for extracting fatty substances from animal and vegetable tissues. It is also used with a special apparatus to extract bitumen and sulphur from certain stones in which these substances are found. It has been employed in the extraction of aromatic essences. This liquid lends itself also very well to the extraction of the oil from the grounds, and its application to this purpose is greatly practiced.

There are many apparatus employed for the extraction of the oil by means of the bisulphide of carbon. Whatever apparatus is used should have the following advantages:

First—It should not waste any of the bisulphide of carbon.

Second—It ought to save a great deal of time and labor.

Third—The oil of the grounds should be entirely extracted, owing to the property which the bisulphide of carbon has of dissolving fatty substances.

The bisulphide of carbon is poured on and passes through the grounds, which are placed in large metal recipients, and after dissolving in its passage the oil contained therein, it runs into another recipient also made of metal; there it is subjected to a slow heat, and vaporized so as to free the oil, which is poured into a separate vessel. The vaporized bisulphide of carbon is in turn passed through a cooling apparatus, where it is reduced to the liquid state, and it is used again in subsequent operations.

The third method of extracting the oil from the grounds is that of steam; it is called "system of hot pressure," and it will be of sufficient importance therefore to here describe this system.

The practical way of working is as follows: The grounds are taken out of the cellar and put into the crusher, which makes from eighteen to twenty turns per minute, in quantities of about one hundred and thirty to one hundred and fifty pounds at a time. As soon as they have been well triturated the pallets placed within the crusher are taken down and the gate at the lower edge opened, so as to let them fall into baskets underneath, and the baskets are in turn emptied into mechanical conveyors, in the buckets of which the grounds are carried to the heating pans above the presses, one heating pan being provided for every two presses.

The grounds deposited in the heating pans are continually stirred up by means of mechanical stirrers. In every one of these heating pans

is a tube through which the exhaust steam from the engine is diverted onto the grounds contained therein. When these grounds have been thoroughly heated, the gate at the bottom of the pans is opened, and they are allowed to drop into the outer box of each press.

The heated grounds are placed in the outer boxes of these presses in the same manner as olive paste treated cold is, that is to say, they are dropped in by degrees, rammed down, and disposed in layers separated by diaphragms. The filling of the boxes occupies about ten minutes.

As soon as the boxes are filled the valve of communication between the pump and the press is opened, and the pressure brought on and kept up for about thirty or forty minutes.

Whenever it is time to unload, the discharge valve is opened for a moment, but as soon as the outer box has detached itself from the hinged top it is closed again and the valve of communication between the pump and press opened, in order to bring on the pressure once more, care being taken to open the three pieces which compose the hinged top by swinging them out of the standards of the press. Then the piston rises, and in its movement of ascension pushes the grounds out of the box, and as these are no longer held in check by the top, they may be taken without difficulty.

The oil which flows out of the four presses through a conduit is poured into a recipient, or into a large tank lined with sheets of tin on the inside, and of a capacity sufficient to hold the product of two or three days' work. The steam which has served to heat the grounds in the pans is passed through the tank containing the oil by means of a tube of forged iron, made like a worm, and it not only serves to heat the oil, but also helps its clarification.

As soon as it is seen that the oil on the top of the recipient is wholly clarified, it is taken out and poured into another recipient destined for this purpose. To prevent very serious losses it is necessary to warn people that the recipients containing the fine oil must be kept separate from those containing the oil of grounds. By keeping them together in the same place, the oil of grounds injures very much the quality of the fine oil, and occasions a heavy decline in the price it brings.

CHARACTERISTICS AND USES OF OLIVE OIL—CLARIFICATION AND DEPURATION OF THE OIL.

The oil that has been extracted from ripe and fresh olives, and has been clarified, has a color varying between amber yellow and greenish yellow, and a sweet and agreeable taste. It is without odor, or rather recalls a little the odor of the fruit. It is very fluid, transparent, and unctuous to the touch. It boils at about 330 degrees Centigrade, and a few degrees below zero it solidifies and takes the form of a buttery mass with radical crystals. Agitated with a mercurous-nitrate solution it solidifies; the "oleine" is transformed into "elaidine." Exposed for a certain time to the air it absorbs oxygen and becomes rancid. When pure and kept in cool places it is altered with much difficulty.

The chemical composition of the oil is:

Carbon	77.21 per cent.
Hydrogen	13.36 per cent.
Oxygen	9.43 per cent.

Its specific gravity at 12 degrees is 0.9192, a specific gravity which diminishes with the increase of temperature, and augments with the decrease of the same. It is insoluble in water, and very little soluble in ether and alcohol. It is the type of fixed oils, and is distinguished from the volatile by leaving a stain upon paper which does not disappear with heat.

The uses to which olive oil is applicable are very numerous. It is chiefly employed for table uses, for the fabrication of soap, for the working of wools, for illuminating purposes, and for the lubrication of machinery.

In the first case it is partly superseded by butter, lard, and even oils from certain seeds, but in many instances it has an absolute superiority over other fatty matters.

For palatableness it is considered as the first and best fatty oil, especially in the seasoning of food; also because it keeps longer and is less subject to alterations. In the manufacture of soap are also used palm oil and the oleine obtained from tallow in the fabrication of candles, but olive oils of inferior quality are, nevertheless, preferred, and are much sought for. The same may be said in regard to the working of wools and the lubrication of machines. In the matter of illumination, however, olive oil finds strong competitors in gas, in petroleum, and in the animal fats from which good and cheap candles are made.

From what has been said it may be easily inferred of what importance olive oil is in life, and how it is our highest duty to produce a larger quantity and better quality of oil, to treat the tree with a little more judgment, and to use greater care in the fabrication of the oils.

The oil after it has been collected from the tubs or the vat still contains matters in suspension which render it turbid, and it is not expedient, therefore, to put it into the store-room, where it must not enter unless clarified and depurated; but it is necessary to subject it first to clarification and depuration.

The clarification of the oil may be effected by natural means, as by rest and decantation, or by artificial means, such as filtration and treatment with alkalies, acids, etc.

The natural means, the filtration, and the vegetable acids are employed for fine oils, the treatment with mineral acids and alkalies for the common oils.

Truly, the clarification of the oils is not the business of the producer, but of the manufacturer; inasmuch, however, as the producer is generally manufacturer in the branch I have undertaken to treat, I do not believe it superfluous to say something in regard to it.

As soon as collected the oil is put into the basins described, in which it is allowed to rest for a few days, the basin being covered with suitable lids so as to prevent dust from falling into them. Thus at rest, the oil frees itself from the albuminoid substances, from the water, and also from certain finely crushed green particles of fruit, which are precipitated to the bottom of the basin, and it becomes clarified. If the clarifying-room has a southern exposure, and it is kept at a temperature of 12 to 15 degrees Centigrade, which is the most favorable to the clarification of the oil, the latter becomes limpid in a short time. Whenever it is perceived that the precious liquid has freed itself from the impurities, it is transferred into other basins to separate it from the sediment lying at the bottom of the recipients, and it is again allowed to rest, to

be subjected afterwards to a second, then to a third, and, if necessary, to a fourth decantation. At least five or six days must elapse between each transfusion. Whenever desired, one may also effect the transfusion by means of pumps similar to those employed for transfusing wine. The sediment left by the oil in the basins should be deposited in a settling tank, as it yields a little oil in the course of time.

The oil having been clarified, it may be definitely put into the store-room, bearing in mind a few rules which will be indicated later. If the producer or merchant of fine oils is not obliged to sell or use them a short time after they have been extracted, he can obtain, by means of the natural clarification above mentioned, any degree of fineness he may desire, because the oils continue to clarify in the store-room. But it frequently happens that the need of raising money to meet expenses constrains him to sell his oils a short time after they have been expressed from the olives; and as the oils then cannot clarify of themselves quickly, owing to the low state of the temperature, he has to resort to filtration to avoid a slight turbidness in the oils, which would cause a diminution in the price.

I have sufficiently spoken of the filters in a previous chapter; hence, there is no need of describing them any further, nor is there any use of explaining how to handle them, as this is a very simple matter. It is merely sufficient to pour the oil to be clarified into the upper part of the filter, which has been previously prepared, and to collect it afterwards at the bottom of the same in a purified state. It is well to remark, however, that whatever be the kind of filter employed it always gets clogged up with the substances abandoned by the oil, and the latter then can no longer pass through. It is customary with some people, in order to make the filtration more effective, to mix with the oil before pouring it into the filter one twentieth of water, which, separating itself afterwards from the oil, carries off the mucilaginous substances.

The vegetable acids, such as the citric and the tannic, are better adapted than the filters to the clarification of the fine oils. By treating the oil with a diluted solution of these acids it clarifies in a short time, and in a perfect manner. The acids act upon the foreign matters in the oil chemically and mechanically. Chemically, by combining with the coloring and albuminoid matters held in suspension in the oil, and precipitating them to the bottom of the recipient; mechanically, by forming with the same a kind of net, which carries down with it as it descends the other heterogeneous particles, which it finds in its passage. In this way the oil becomes completely depurated without losing the sweetness, the perfume, and the daintiness which it possesses.

One must absolutely avoid an excess of acids, as such an excess would destroy the odorous particles of the oil, and, besides, the acids themselves might communicate their own savor to the oil by remaining in suspension. If the quantity of acid to be used could be determined in advance the inconveniences indicated would not occur, but the diversity of the oils, the larger and lesser quantity of albuminoid matters which they may have in suspension, and other circumstances inherent in the climate, the meteoric changes, the degree of the acid solution, etc., are all causes which affect the degree of impurity of the oil, and hence the quantity of acid to be used. It is expedient, therefore, in order to avoid the excess pointed out, to make experiments on small quantities, so as to be able to treat the larger mass with security.

For the preparation of the tannic solution, I refer the reader to a previous chapter, and as to the citric solution, it is prepared simply by pressing the lemons, mixing their juice with the water, and passing the mixture through the filter. The solution, whether tannic or citric, is poured little by little into the basins containing the oil, and the mass is beaten with a bundle of twigs, after which it is allowed to rest, and the recipient covered. The oil is purified in twenty-four hours, and it then may be deposited in the store-house. The residue should be carried to the pit of the oil grounds. Besides the means indicated, the oil may also be purified by the simple washing with water, which acts upon the mucilaginous matter, and upon the extractive and coloring principles.

In shaking the oil with the water the mixture becomes white immediately, owing to the interposition of the water between the molecules of the oil, but upon being allowed to rest the latter comes to the surface of the water clearer, and consequently purer and more edible.

It is advised to add to the water about one half per cent of tannin of commerce, which would contribute much towards depriving the oil of the mucilaginous and albuminoid parts. This would be but a treatment with acid much lengthened.

The common oils are sometimes purified by means of filters, but most manufacturers have resource to the chemical processes, as the filters cannot succeed in rendering them clear.

PRESERVATION OF THE OIL.

The oil, as we have seen, being a body easily altered both by increase of temperature and a prolonged contact with the air, it becomes indispensable, in order to preserve it well and unaltered, to store it in places where it may escape these baneful influences. To accomplish this it is necessary that the store-house be cool, dry, and well aired, situated in such a way that its temperature may be kept rather even, as in the cellars where wine is preserved, and that it be far from any place emitting bad exhalations. The store-house, therefore, in order to possess all these conditions, must have a northern exposure, and have its interior very clean.

The jars, tin vessels, or pots in which the oil is kept, should be placed all around the inner walls of the store-house, and the walled reservoirs or cisterns in the center of the same. If these latter do not exist, the center of the room may then be occupied by a circular group of jars; provided, however, there always remains sufficient space for attendants to move freely, and to permit the transfusion of the oil from each recipient. The cleanliness of the oil factories cannot be sufficiently recommended.

The oil recipients, whether they be new or old, must not be filled before they are washed with water containing 5 per cent of soda, then rinsed with clear water, and afterwards dried with a sponge.

As a general rule jars are to be preferred, especially for the preservation of fine oils, to the large reservoirs, for several reasons. In the first place, the recipients of smaller capacity lend themselves better to the clarification, which continues to take place in the oil, and to the transfusion of the latter; and they offer in their small volume a more extended space, and hence favor more the deposit of the sediment. Moreover, the separation of the different qualities of oil, and their examination, are rendered more easy by the use of the smaller recipients. It must not

be expected, however, that the dealers in inferior oils, fit only for the fabrication of soap, the lubrication of machinery, etc., and who consequently have to handle large quantities of oils, will make use of jars, as it would subject them to heavier expense, for the reason that they would need an extraordinary number of jars, and hence larger store-houses. For the common oils the walled reservoirs are to be preferred. In a few words, it may be said that edible oils should be preserved in rather small recipients, such as jars, pots, or jugs, in which they may be looked after more easily, and that the inferior oils may well be kept in large reservoirs, as they are seldom transfused.

The new oil, although it may have been subjected to the processes of the clarifying-room, and decanted over four times, cannot be said to be wholly purified, as it still holds heterogeneous particles, which it can abandon only in course of time. This is the reason why oils that have been clarified and placed in the store-house continue to purify themselves, and hence, to deposit at the bottom of the recipients a more or less thick layer of sediment. Were the oil kept over this deposit, it would run the risk of getting spoiled, with the rise of the atmospheric temperature during the summer months; it is expedient, therefore, to liberate it from the sediment by means of the decantation. To this end it is convenient to always keep in the store-rooms a few empty and clean jars, into which the oil may be decanted whenever desired. The time most favorable to the decantation is the autumn or the spring. The winter would lend itself badly to such an operation, as the oil becomes more dense with cold, and keeps the impurities within itself. The summer, in turn, is not propitious to the decantation, as the hot sun would excite in the oil an effervescence, which, far from allowing the foreign substances to fall to the bottom, would keep them in suspension throughout the mass of the liquid.

The transfusion may be effected either by means of recipients, or by pumps similar to those used for wine. The recipients employed may be made of wood, terra cotta, tin, or zinc. The recipients of baked clay, tin, and zinc are cylindrical in shape, and have their mouths narrowed in so that they can be stopped. Whatever the recipient employed in the transfusion, it is necessary to fill it up completely every time, and close it well so as to prevent the oil from coming in contact with the air, and hence undergoing any alteration.

It is customary with good oil manufacturers to decant the oil twice a year, precisely as is done for wine, care being taken to keep it from contact with the air, in order to prevent the oxygen of the latter from exercising its action upon it and making it rancid.

There are some who separate the oil of the upper part from that placed between it and the sediment, effecting the separation at the time of the decantation. The first is designated by the name of clear, edible, and the second is termed oil from under the clear, oil from under the edible, etc. The difference between the two oils is that the first is more depurated, more palatable, and more fragrant than the second. And this is because the suboil still contains some substances in suspension, which, however, may subside later, and allow it to become as clear as the surface oil.

The oil having been decanted, there only remains at the bottom of the jars the sediment and a little oil of very low grade, which can be collected and employed for burning purposes. As to the sediment, it

must not be thrown away as useless merchandise; but it should first be boiled, so as to obtain from it a little more oil, but of a very inferior quality.

DISEASES AND FALSIFICATIONS OF OLIVE OIL—MEANS FOR PREVENTING THE FIRST AND DETECTING THE SECOND.

Olive oil, like wine, does not keep if it be made without care, and it contracts diseases and spoils itself if exposed to the air for a long time. Science has spent much labor upon the diseases of wines; it has discovered the different alterations they may be subject to as well as the causes producing them, and it has suggested many remedies to counteract these alterations. The same cannot be said of the oil. The oil has been little studied; few scientists pay any attention to the alterations which it may undergo, and, consequently, of all the ills it endures, we know of but the rancidity.

Rancid oil has a disagreeable odor, a harsh and pungent taste, and a dark color. The cause of this alteration is attributed to the oxygen of the air, which being absorbed by the oil forms fatty acids, and especially the sebaceous, which liberate themselves.

The rancidity is produced because the mucilaginous and parenchymatous matters contained in the oil act as a ferment, putrefy, and produce the separation of the oleaginous or glyceric molecules, which become rancid all the sooner the more these matters are heterogeneous to the oil. Besides the formation of the fatty acids, it is believed that the oxygen forms also in the oil a little acetic acid.

The rancidity modifies after a certain time the density of the oil. That of olives diminishes in proportion as the degree of the freed acids or the rancidity augments; in the oils of sesame, of poppy, of cotton seed, etc., on the contrary, the density increases.

The proportion of the rancidity being variable, it is indispensable to know how to determine it in certain cases, as when it is to be decided whether the rancid oil should be employed in the manufacture of soap or for lubricating machinery, and also when it is a question to fix its price. Many are the means suggested for determining the degree of rancidity, but the most simple, and, perhaps the most exact, is the one founded upon the solubility of the free acids of the oil in alcohol.

The process in practice is as follows: One ounce of the oil under examination is put into a glass retort, together with two ounces of alcohol, at 92 degrees. The temperature of the mixture will be seen to rise to 30 degrees. The retort is next immersed in a water bath, agitated for a few minutes and then allowed to rest. The alcohol which holds the free acids in solution separates from the oil, which is precipitated to the bottom of the retort, and when the separation of the oil from the alcohol appears well defined, one ounce of the latter, or half what has been employed, is taken out, and hence, also, half the dissolved free acids. This ounce of alcohol is put into a capsule, previously weighed, and it is exposed to a gentle heat. The alcohol evaporates and the free acids remain in the capsule. The weight of this residue multiplied by ten gives the quantity of rancidness per cent.

Truly, such a calculation is not rigorously exact, because the ounce of alcohol taken out of the retort and weighed does not represent the weight of the alcohol alone, but also that of the acids dissolved in it, and,

therefore, by computing in the manner indicated is committed an error which becomes the greater as the oil examined contains more rancidity. It is expedient, therefore, to correct the above calculation. This may be done simply by weighing the residue left at the bottom of the retort, and subtracting the amount from the ounce taken out, and thus will be had the true weight of the sole alcohol. Thus, if the residue amounts to .20 ounce, the 1 ounce of solution represents .80 of alcohol and .20 of acids, and consequently with the proportion .80:.20::1:x, we have .25, which is the true quantity of rancidness in each ounce of alcohol, and hence the actual quantity of rancidness in our case would not be represented by $4 \times 10 = 40$ per cent, but rather by $5 \times 10 = 50$ per cent.

To prevent rancidity in the oil one must, above all, clarify it well, as it does not very easily become rancid after it has freed itself from the mucilaginous and parenchymatous matters, and then use every effort to keep it in cool places and prevent its contact with the air.

Various remedies have been proposed to free the oil from the rancidity, but they do not all answer the purpose. I will, therefore, mention the most efficacious only.

We have seen that the rancidity of the oil is caused by the free fatty acids. If these be percipitated the oil must remain sound. The treatment with magnesia is the most rational and the most efficacious for this purpose. The proportion in which the calcined magnesia must be employed is of six and six tenths pounds to each two hundred and twenty pounds of oil. The magnesia is added to the rancid oil, which has been previously put into a recipient made of glazed terra cotta, or even of wood, and both are agitated together about six times a day, for a quarter of an hour at each time, during five or six days. The oil is then filtered and washed with boiling water, to give it a good taste and restore to it partly what it has lost. Soda might be used instead of magnesia, but the latter produces better effects.

Good results have been obtained by the use of alcohol. By mixing together ninety quarts of rancid oil and ten quarts of alcohol of good quality, and agitating the mass for half an hour, the alcohol subsequently separates and takes off the rancidity. It is necessary, however, to repeat the operation at least three times in succession in order to cure the oil completely. The alcohol is then purified with one fiftieth of slaked lime, and used again in other operations.

It is held by many that by mixing and agitating well twenty-five parts of rancid oil with five of vinegar, and repeating the operation three or four times in succession, the oil may be cured of its disease. One can also cure the oil completely of its rancidness by mixing and agitating strongly for half an hour fifty parts of oil with eighty of water at the temperature of 30 degrees Centigrade, containing twelve parts of common salt. The mass being allowed to rest, the water falls to the bottom of the recipient and the cured oil rises to the surface. In order that the effect be complete it is necessary to repeat the operation six times.

Of all the remedies reviewed, the magnesia is the one which gives the best results, and I do not hesitate in giving it the preference in the treatment of rancid oil. However, it is necessary to state that oil which has been treated for rancidity must be consumed immediately, as otherwise it might spoil once more.

PLUMS AND PRUNES.

THE PRUNE.

The "California" prune has made a wide reputation for itself in all the markets of the United States. A few years ago a box of "California" dried prunes were indeed very rare, but progress has made rapid strides, and at the present time our "California" prunes sell in advance from 1 to 2 cents per pound over the imported. The consumers have discovered for themselves which, according to quality and taste, best meets their wants, so to-day the "California" prune is master of all the markets to which it is exported.

NOMENCLATURE.*

The question of prune nomenclature remains at present unsettled. Pomological works describe some twenty-five distinct varieties. The term "prune," in the English language, signifies those varieties of plums that, when dried, are sweet. "Prune" is merely the French way of spelling "plum."

Here lies the source from which errors have sprung, many varieties of "plums" having been imported to California from Europe, and brought here by foreigners under the French name "prune," while in reality they may not have had the slightest right to the name "prune," viz.: a sweet dried fruit, as we understand it here.

For example, take what is commonly called Hungarian prune, and by shippers Gros prune, thereby creating a very erroneous and harmful impression upon the public as to the individuality of a California "prune" in a fresh state, for this Hungarian, so called, is nothing but a large, very showy plum, the other being extremely acid, and, as a dried fruit in any shape, neither profitable nor desirable. The correct name of this fruit, as Mr. John Rock has pointed out, is undoubtedly Pond's Seedling.

The prune generally cultivated here as † French prune, Petite d'Agen (petty prune), I believe to be synonymous with what Downing describes under the name of Prune d'Agen, having also seven French synonyms. There is one other variety, described by Downing, called Burgundy prune, which so nearly resembles it that it is doubtless either a seedling, or was grown under different conditions, which caused some modifications in its appearance.

I do not see any reasons for disputing the statements made years ago by Mr. W. B. West, of Stockton, after his visit to the prune-growing districts in France: First, that the prune known here as Petite d'Agen is the prune of Agen, the term "Petite" having been locally applied to

* Leonard Coates. Biennial report, 1887-8.

† Changed to "California." (See proceedings of Thirteenth State Fruit Growers' Convention.)

it in California, owing to its small size in comparison with other fruits; and second, that from time to time seedlings have been originated by the peasants, from which have arisen varieties, or sub-varieties, differing slightly from their parent, and yet being so nearly similar that all have been propagated under the generic name of Prune d'Agen.

I wish also to reiterate what I have said on a former occasion, that the French prune is liable to very noticeable outward changes, subject to stock, soil, and the season. I have grafted the same season large trees of apricot, German prune, and almond, with scions of French prune from the same stock, and, in two years, when all were bearing some fruit, the prunes differed very much in size and color. Some were as large as a small Pond's Seedling (Hungarian), showing that by heavy pruning and thinning the French prune will be as large as those that are graded by the French as their largest select fruit, but which are so large that many have thought, and so stated, that they must have been of another variety.

A prune that I imported from France, under the name Prunier Datte, is identical with the variety called by Mr. Rock, Robe de Sergent. I have both trees growing and fruiting together.

By reference to Downing, it will be seen that Robe de Sergent is given as a synonym of Prune d'Agen, and further the significance of the term Robe de Sergent, referring to the varied colors in a recruiting Sergeant's uniform, is lost entirely if applied to this fruit, which is nearly round, and of a dark purple color, never assuming those varied colors so often seen in the Prune d'Agen, or French prune.

I am therefore entirely at a loss as to the correct nomenclature of this variety. The wood and habit of growth are very similar to those of the French prune, but the fruit is very distinct.

The prune described by Charles Downing as Imperiale de Milan seems to be identical; it is as follows: "Tree vigorous, rather spreading, branches smooth. Fruit rather large, roundish oval. Suture broad, extending two thirds around one side, often enlarged. Skin deep purple, covered with a thick blue bloom. Stalk stout, set in a small cavity. Flesh greenish, juicy, sugary, adheres to the stone. Good. Early September."

The late Charles Downing accomplished a great work in classifying and describing the known varieties of fruits cultivated in this country and in Europe; but the most casual observer will notice at once the great number of synonyms tacked on to some of the fruits described. For instance, the variety under discussion is known in different parts of Europe as "d'Agen," "Prune d'Ast," "Robe de Sergent," "Agen Datte," "St. Maurin," "Prune de Brignole," and "Prune du Roi." Downing selects the name "Prune d'Agen" as correct, which coincides with Mr. West's conclusions when in France. "It is," says Mr. West, "undoubtedly the prune of Agen, cultivated there exclusively and in great quantities."

But nowhere do we find the name "Petite," or "French," both of which are of purely Californian origin. It is deplorable that we in California should have done so much to aid the already existing confusion in pomological nomenclature.

A cut of the Prune d'Agen, in "Downing," shows an outline which, together with the description given, exactly coincides with the fruit raised here as "French," or "Petite" prune.

The question is asked, "Have we the true type of French prune in California?" I answer, positively, "Yes." We have, however, another distinct variety of French prune in California, of which I do not know the name. This is the variety which has been called "Robe de Sergent" in the nurseries here; but as Downing gives "Robe de Sergent" as a synonym of "Prune d'Agen," it cannot be correct. It does not answer to the name "Robe de Sergent," being of a uniform color, and more sombre looking than d'Agen. Its growth is similar to d'Agen, but coarser and stronger, and the leaves are larger and much more shiny. I obtained some stock direct from France, and some, also, of the stock imported by Mr. Rock. They proved to be identical. It is rounder than d'Agen, with one side enlarged, and is more decidedly a clingstone, and more juicy.

The same prune about Napa City, and anywhere in the vicinity of the bay, is of a dull purple color; while those raised in the hot, sunny climate of Calistoga, at the upper end of Napa Valley, become a vivid crimson, some being beautifully mottled, readily explaining why the synonym "Robe de Sergent" should be applied to it.

I consider the question of the correctness of the variety generally cultivated here as "French prune" clearly proved, but suggest that we follow Downing and call it simply "Prune d'Agen." *Commercially* it will still be "French prune."

I am fully convinced in my own mind that the prune called here by nurserymen Robe de Sergent, is really the Prune d'Ente of Bordeaux.

PRUNE D'ENTE.

Syn., *Robe de Sergent.*

[Fig. 7, Plate II.]

In the past few years much has been written and said about a prune known by its synonym of "Robe de Sergent," and has been classed under various types of prunes grown in several districts of France. This variety was originally imported from France by Mr. John Rock, of Niles, Alameda County, and also by Mr. W. B. West, of Stockton. There is quite a marked difference in the size and quality of this prune compared with the Prune d'Agen (Syn., French), but the difference had not been noted from a shipping standpoint until quite recently.

"This prune is medium (to large) in size, and oval in shape, with a deep purple skin, approaching black, and covered with a thick blue bloom; flesh greenish yellow, sweet, and well flavored, sugary, rich, and delicious, slightly adhering to the stone."—Rock.

The tree is quite an upright grower, and has a much broader leaf than the Prune d'Agen.

*The first trees of the Prune d'Agen (French, so called) were grown by Louis Pellier, at San José, about the year 1857, the graft having been brought from France by his brother in December, 1856.

The French prunes, which are so largely exported from France, are made of the Prune d'Agen, or date plum, which is also named Prune d'Ente and Robe de Sergent. The Prune d'Agen is, according to the best authorities, the plum from which the finest French prunes are made,

* Hon. W. H. Aiken, Report, 1885-6, p. 290.

EXPLANATION OF PLATE II.

NEW FRUITS.

Fig. No. 1. Apricot-plum (*Prunus simoni*); natural size and color; mature.

Fig. No. 2. Apricot plum, divided; showing the size of the pit and flesh; also, its amber color before changing to brick red, and size and shape of the pit.

Fig. No. 3. Clyman plum; natural size and color; mature.

Fig. No. 4. Clyman plum, divided; showing size of pit and flesh.

Fig. No. 5. Tragedy prune; natural size and color.

Fig. No. 6. Pit of Tragedy prune; natural size.

Fig. No. 7. Prune d'Ente (Syn., Robe de Sergent); natural size and color.

Fig. No. 8. Pit of Prune d'Ente; natural size.

[illegible]PLANATION [illegible] PLATE II.

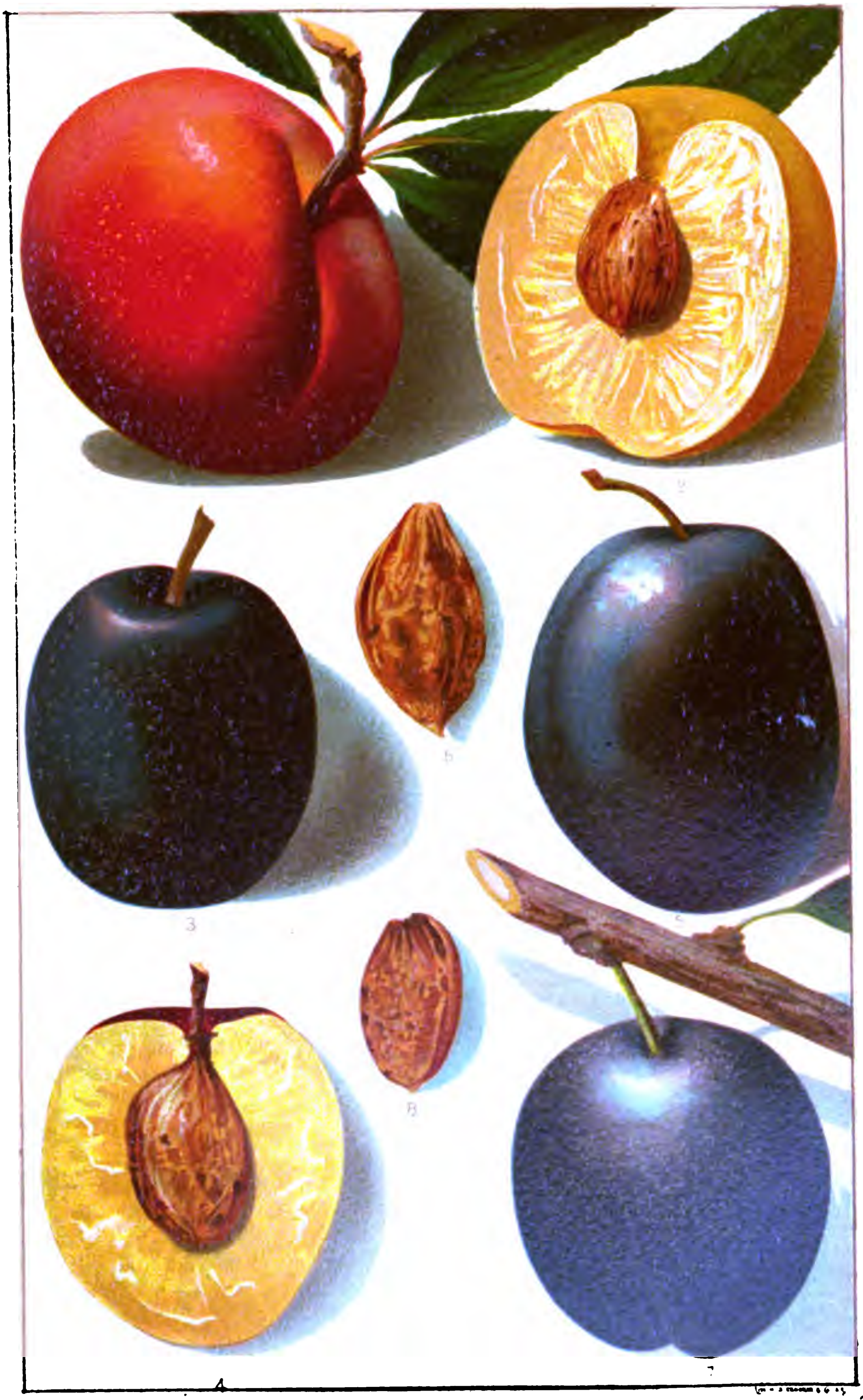
[illegible]

[illegible]

[illegible]

[illegible]

[illegible] natural size



PLUMS AND PRUNES.

and is known as the prune of commerce. Orchards have been planted and cultivated in California for nearly thirty years, under the impression that we had the true prune of commerce, cultivated in France under the name of Prune d'Agen.

This was first seriously questioned by Mr. Felix Gillet, a Frenchman by birth, and a prominent and enterprising nurseryman at Nevada City, California, who asserted in July, 1884, that our Prune d'Agen (French) was very different from the Prune d'Agen of France, both in size, color, shape, and time of maturity.

He based his opinion upon the conclusions drawn by certain horticulturists in France, from an actual comparison of the prunes raised and sent to them by him for that purpose with what they claimed was the true Prune d'Agen.

They failed to agree upon the points of difference, one insisting that the California prune is a seedling from the Prune d'Agen, and not as large and fine; another, that it is the same in shape, but not so regularly ovoid; another, that it is the same shape and color, but that there is a difference in the pit; and still another, a leading prune merchant of Agen, France, that it is exactly the kind known in France by the name of Prune d'Agen, or Prune d'Ente, and that the nature of the soil has much to do with the beauty and size of the fruit.

Mr. Gillet, desiring to correct the error, and to introduce in California the Prune d'Agen, obtained trees from the north and south of France, and spared no expense in fully investigating the prune subject.

His investigations up to November, 1885, resulted in a change of opinion, as shown in his letter to the State Horticultural Society, in which he makes the following statement: "Our prune is a true type of the Prune d'Agen, and the kind grown in the north of France and the Valley of the Loire." Our prune is not the very type of the Prune d'Agen, cultivated in the Valley of the Lot, in France, where are grown the largest prunes, which are sold by merchants of Agen and Bordeaux under the name of Prune d'Ente or d'Agen.

Through the kindness of Mr. Gillet, I sent to a horticulturist at Agen a small package of my own prunes for inspection. In reply, under date of August 16, 1886, he states that my prune has the shape and color of the Prune d'Agen, but is not the same type, the difference being in the pit, and sent me two pits of his prunes for inspection and comparison.

I am of the opinion that the French prune of this State is a true type of the Prune d'Agen, the prune of commerce of France, resembling it in shape and color, though differing in pit; the exact difference I am unable upon inspection to clearly define. This slight difference may be owing to climatic influence.

TRAGEDY PRUNE.

[Fig. 5, Plate II.]

This valuable plum, which is of California origin, was originated at Courtland, Sacramento County, on the Sacramento River, by Mr. O. R. Runyon.

One of the great points in favor of this prune is that the tree is scale proof, being in this respect similar to the Black Tartarian cherry. The tree is a rapid grower and of a beautiful form. The fruit is quite large,

and as shown in the illustration, of an elongated form, with dark purple skin. The flesh is yellowish green, and has a very rich flavor, and quite sweet, being so as soon as it begins to color into ripeness. This prune is among the first of early fruits (ripening in June), and commands very high prices for shipping. In the past two years shippers have bought the fruit of all orchards of this variety much in advance of other early plums. As a shipper it has given great satisfaction.

APRICOT PLUM.

Prunus simoni.

[Figs. 1 and 2, Plate II.]

This plum is of Asiatic origin, and until recently has been but little known. This is no doubt due to the fact that no attempt had been made to cultivate and test its qualities on a large scale. My first attention was called to this plum in the spring of 1887, when ripe specimens were exhibited before any other plum of any importance from a shipping standpoint. The experiments conducted in the past few years by Mr. I. H. Thomas, of Visalia, have demonstrated the fact that the plum is of more economic value than was at first supposed, and the shipments made last and this year fully establish this fact; letters from commission agents in the East being herewith appended to show its merits.

The plum, as shown in the illustration (Fig. 2, Plate II), before maturity is of an apricot yellow and very aromatic. In this state of ripeness it is very firm, and unlike many early plums is sweet before it reaches maturity. I have had specimens remaining as long as two weeks before beginning to assume its reddish cast. All these specimens, however, were at that state of ripeness quite sweet and palatable. In this state of ripeness it is quite aromatic and has a marked pineapple flavor. On ripening it assumes a dark brick-red color, as shown in the illustration (Fig. 1, Plate II). The pit is very small, as shown in the illustration (Fig. 2, Plate II), and adheres tightly to the flesh. There is no cavity between the pit and the flesh, as is the case with other plums of this species.

The tree does not attain a very great height, yet it is by no means a dwarf. The foliage resembles the foliage of the Satsuma plum. The tree is an upright grower.

This plum is indeed a valuable acquisition, because of its superior quality, and will prove profitable to grow.

Extracts from a Letter from Johnston & North, Commission Merchants.

NEW YORK, July 31, 1890.

I. H. THOMAS, *Esq., Member of State Board of Horticulture:*

DEAR SIR: In reply to your favor of the fourteenth, with regard to the "Prunus Simoni," we take pleasure in handing you the following report: We received the crate by express from Messrs. Sherman, Marr & Higgins, of Chicago, Ill., at 9 A. M., June 30, 1890.* On examination we found the prunes to be sound and mostly hard, with some of them softening into ripeness, and all of them throwing the sweat onto the wrapping paper, which takes place from four to seven days (according to the weather) before fully ripened. A few of the prunes had a tendency to rot on that part where they have been bruised against

* Shipped from California (Visalia) June twenty-third, in a tight baggage express car.

the box, but their main body was in good condition and not yet fully ripe. We kept it (the crate) in our cellar where it was cool, *without submitting it to any artificial low temperature*. Although the papers were damp from sweat, there was no noticeable heat in the fruit, but there was sufficient dampness to start heat in a few days. In one corner of the box there was the first sign of heat, in the shape of a slight cobwebbed mildew on the outside of the wrapping papers. On July first we made another examination at 5 P. M. (or, say thirty-two hours after the first examination, during which we had two very hot, sultry days), and found the fruit yet to be sound, but a good deal softer, and the papers had sweated up considerably more. The fruit had also ripened much more.

On July second the weather was rather cooler, and examination showed the fruit to be a shade riper.

On July third (weather cool), the change to further ripeness was hardly noticeable from the condition on July second. On July third, we shipped it (the crate) on the steamer "Umbria" to Liverpool.

Yours truly,

JOHNSTON & NORTH.

Mr. Thomas shipped, on June 14, 1889, to Messrs. Sherman, Marr & Higgins, of Chicago, a crate of plums in a tight baggage express car, the color of the plums then being light yellow; and received the following letter as to the keeping qualities of the plums, which is self-explanatory:

CHICAGO, June 20, 1889.

I. H. THOMAS, *Visalia, Cal.:*

DEAR SIR: We are to-day in receipt of the crate of "Prunus Simoni;" they are in good condition; the color is similar to a red June cherry, or dark red color. We will keep them according to your request, and report how long they will keep. Accept thanks for the shipment.

Very truly yours,

SHERMAN, MARR & HIGGINS.

On July 16, 1889, a letter was received, reporting the keeping qualities of the plums, as follows:

CHICAGO, July 10, 1889.

I. H. THOMAS, *Esq., Visalia, Cal.*

DEAR SIR: We have kept the "Prunus Simoni" two weeks, and find that they have carried in excellent condition, but are rather soft at this time; color, very dark red, almost black; flavor, fine.

Truly yours,

SHERMAN, MARR & HIGGINS.

CLYMAN PLUM.

[Figs. 3 and 4, Plate II.]

The "Clyman" plum was raised from seed planted by Mrs. Hannah Clyman, near Napa City, about the year 1865. The tree grew too large, being near the house, and was cut down, but at Mrs. Clyman's solicitations several suckers were cut off the root and planted in the orchard. These have for many years borne fruit like the parent tree, never yet failing to mature a full crop. Mrs. Clyman, who has lived in California since 1848, says that the fruit has always been eagerly sought after by neighbors.

In 1886, the attention of Mr. Leonard Coates, the nurseryman and fruit grower of Napa City, was first attracted to this plum, it being then ripe at the same time with the common "Cherry" plum, in that locality (Napa), about June twentieth, in average seasons. In warmer sections of the State it has since ripened about June first, or earlier.

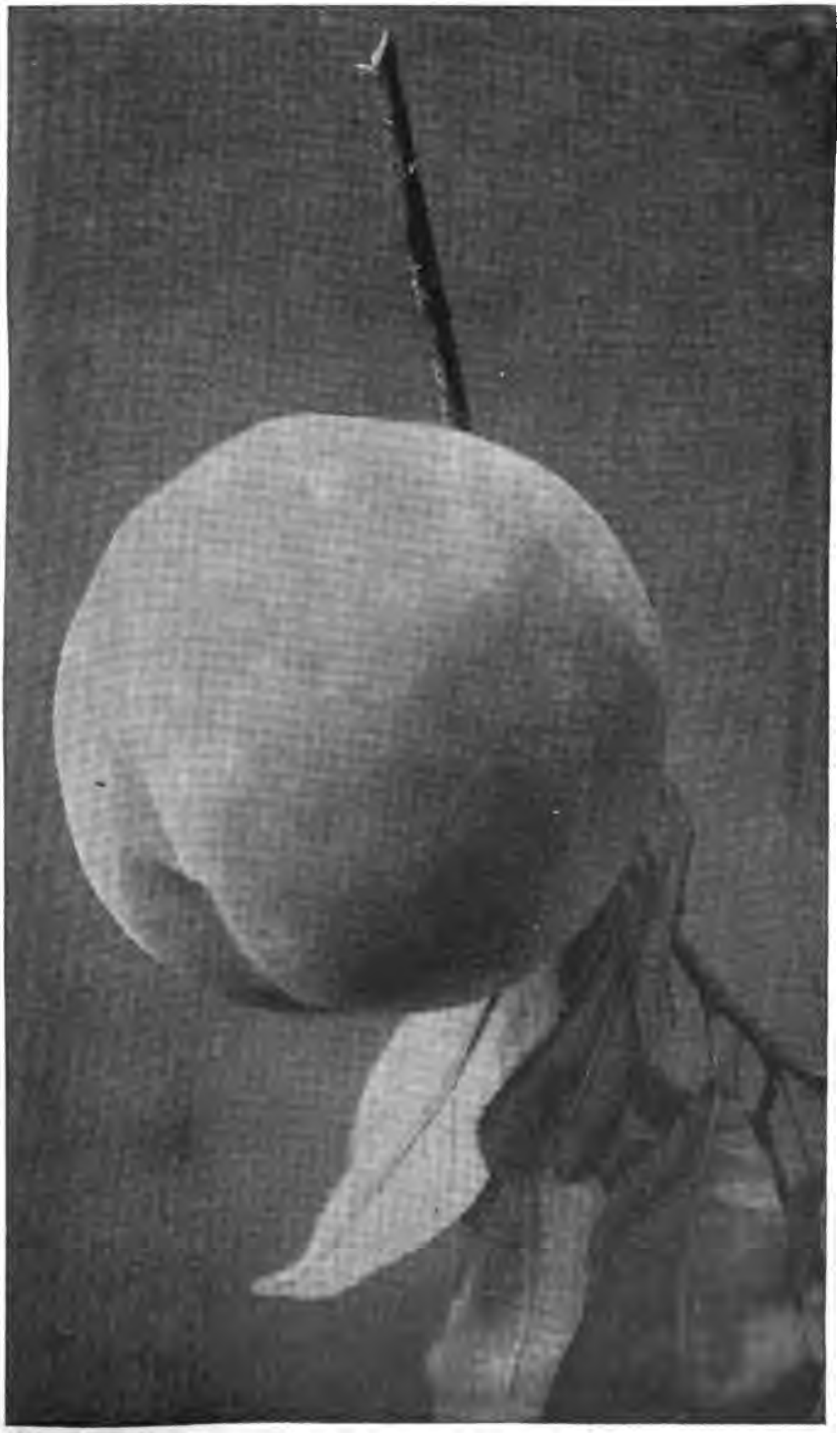
As shown in the illustration (Figs. 3 and 4, Plate II), the plum is of good size, even when growing in clusters, and the old trees are growing in an old orchard, overhung by large apple trees, and having very little cultivation. In color it is a rich purple, firm in texture, free stone, and of

superior quality. Indeed, it partakes much of the nature of the Peach plum, of which it seems to be a seedling. The tree is an extraordinary grower.

Mr. Coates reports trees in his nurseries growing ten feet from the bud in one season, without irrigation, while in his orchard the trees grow double the size of other plum trees, under precisely the same conditions.

Mr. Coates distributed grafts in some of the early sections of the State, where they are reported as doing well, and a shipment made to Chicago early in June, 1890, sold at $6 per half crate.

NEW EARLY YELLOW PEACH.



EARLY IMPERIAL.

EARLY IMPERIAL PEACH.

For many years experiments have been carried on by propagators and nurserymen in trying to originate an early yellow freestone peach. So far all the experiments have proved failures, because the quality of the varieties originated were of no economic importance. The first peach of economic value (as such is the Early Imperial) was originated with Mr. W. W. Smith, at Vacaville, and is a seedling of the St. John, fertilized by the Early Crawford. In order to produce this rare variety Mr. Smith budded the St. John onto the Early Crawford. The tree then became one half St. John and one half Early Crawford. The pits from the fruit were then taken and planted; numerous plants were thus produced, but only one of them bore good fruit, which was the one that produced this fine peach, and has continued to bear this handsome fruit for four years.

This peach ripens at least two weeks ahead of the Foster and the Early Crawford; indeed, it is the earliest yellow freestone peach ever originated. It is most beautifully colored, and, what is more, is free from curl leaf. So far it promises to be a good bearer and a thrifty grower.

Mr. Smith carried on at his place very extensive experiments for a period of about twenty years in trying to originate such a peach, and at last his labors were rewarded by its production, which has all the qualities that can be desired, and is no doubt the earliest good yellow freestone peach so far known in the State or elsewhere.

Mr. I. H. Thomas, State Horticultural Commissioner for the San Joaquin District, writes: "I fruited the Early Imperial peach this season on a tree that had a one-year old top graft. The peach was very highly colored, almost a dark red on a yellow ground. peach, and very firm, and I believe it will be a good shipper. The time of ripening with me is about two weeks ahead of the Foster or the Early Crawford, and near the time of Hale's and Parson's Early. The great value of this peach is that it prolongs the time of drying two weeks. It dries fairly well. I consider this peach to be the most valuable acquisition that has been made to the peach family for the past twenty years."

FUNGOUS GROWTHS.

FUNGI.

Unlike ordinary plants, fungi are destitute of leaves, flowers, or seeds, in the ordinary occupation of the term, the productive bodies being known as spores, a name given to the fruit of all flowerless plants. These spores are exceedingly minute, often not more than the five-thousandth of an inch in diameter, are generally nearly transparent, extremely buoyant, and, forming at all times a considerable proportion of the atmospheric dust, are transplanted by the winds to remote distances. These spores are produced in numbers which, to one unfamiliar with the subject, appear almost incredible. Nature seems to have provided with bounteous prodigality for the safety of species of the lower orders, both of plants and animals, and the number of germs produced is in almost constant ratio with the danger to which the organism is exposed. Countless millions of germs may perish, but species live on. As an illustration familiar to all, I will mention the puff-ball, the "smoke" from which consists entirely of spores which separately are quite invisible to the naked eye, and each one of which is capable, under favorable conditions, of reproducing its kind. A single puff-ball (*Lycoperdon giganteum*) is so abundantly supplied with spores that the entire State might be planted from this individual, each square inch of the vast area being supplied with a spore. The consideration of these facts will explain why, when the conditions are favorable for the germination of an unusual number of spores, these microscopic organisms are able to devastate large areas in a single night, as often happens with fields of wheat, in which case it is only necessary in certain localities that there should be a warm, foggy night, continuing for a few hours in the morning and followed by warm sunshine, to produce the "red rust" of the grain, known to the mycologist as *Pruccinia graminis*. Probably every grower is familiar with this parasite, which first shows itself as a minute rusty spot upon the leaf or stem. If it appears before the formation of the head it causes little damage, but if, as occasionally happens, it should attack the plant while the berry is in process of formation it proves disastrous to the crop. In such localities the farmer soon learns to submit without repining to an evil for which no economical remedy can be applied, and to plant to other crops those tracts lying adjacent to the streams, which experience soon teaches him are most liable to be attacked.*

The conditions this year seem to favor fungoid growths. The fungoid diseases of fruit trees need more general attention on the part of the growers, as they rank second on the list of destructive agents, and as yet are but little understood. In the Eastern States where fruits are grown, the growers have suffered immensely from the attacks of fungi. The diseases most prevalent there, such as "Peach yellows," "Plum pockets,"

* Prof. H. W. Harkness, Report State Board of Horticulture, 1883.

"Brown rot of the cherry," "Rust of the orange," "Root rot," "Black rot," etc., have not yet made their appearance in this State, and all precautions should be employed to prevent their introduction. "Extreme conditions of weather are in general unfavorable to fungi, as their spawn is liable to be burnt up by drought, putrefied by long-continued wet, or destroyed by frost."—Berkeley. Thus it will be observed, that last winter, being an extremely wet one, was favorable to the development of all fungoids, and gave but little time for experiment in their destruction. Enough, however, has been observed to warrant the publication of this chapter upon parasitic fungi, though brief as it is, and regretting that a more extended report cannot now be given.

SHOT-HOLE APRICOT FUNGUS.

Septonia cerasina.

[Figs. 1, 2, and 3, Plate III.]

The apricot does not suffer from as many diseases as other trees do. It suffers, however, great damage through the attacks of the shot-hole fungus (*Septonia cerasina*). "It appears upon the leaves as irregularly rounded spots, of a dark brown color, varying greatly in size. (See Figs. 1, 2, and 3, Plate III). The spores are developed beneath the cuticle in black specks, scattered over both surfaces of the spot, and on arriving at maturity rupture their coverings and are borne away by the air. The mycelium penetrates through the cells of the leaf with great rapidity, sapping and exhausting them. The contracted cells separate from the healthy parenchyma and fall to the ground, leaving the leaf perforated by holes (see illustration), from which it has received the name of 'shot-hole' fungus."—Harkness.

This fungus has lately made its appearance in many new districts where it had been entirely unknown. It is first observed on the leaves, as they develop quicker than on the fruit. It appears on the fruit when quite young, and gives it the appearance of being infested by scale. The fungus develops very rapidly and retards the growth of the fruit. At first the fungus appears as small pimples, which develop and burst open at the top; a scab is then formed, which spreads and dries on the surface of the fruit. It appears on the leaves in the same manner, with the exception that instead of spreading on the leaves, it bursts, dries, and shrinks away, leaving a hole in the leaf. The leaves attacked by the fungus have the appearance of having been eaten into by insects. The fungus arrests the development of the leaf, which soon turns yellow, and the tree presents a sickly appearance. Lately it has been noticed that when other trees, such as the peach, nectarine, plum, prune, and even the apple and the pear trees, are near apricot trees infested by the fungus, that it was spread onto them; however, being observed mostly on the foliage, and not enough to cause alarm.

Remedy.

It is only until quite recently that any extensive experiments have been made to suppress this malady. Many growers have felt the attacks of this fungus but slightly, owing to late spraying in the spring of the year (just about the time the buds commence to swell) with the lime,

salt, and sulphur remedy, as well as with other solutions into which fungicides have been added, such as sulphide of copper, sulphide of iron, hyposulphide of soda, sulphur; etc., and others. In adding these ingredients the greatest of care should be exercised that none such be added that will be destroyed by the action of the chemicals contained in the solution to which they are added, as in such instances it cannot be expected that any great benefits can be accomplished by their use. It is possible that the remedies which have been so successful in the treatment of fungoids mentioned in this chapter (apple scab and pear blight), may have a beneficial effect upon this fungus, and therefore they should be experimented with. This season (1889–90) was an extremely wet one, and for that reason such experiments could not be carried out; yet considerable has been done to show that the disease is arrested by this application. To insure good results the remedy should be applied just as soon as the buds begin to swell, and which must be followed by the application of fungicide solutions of a weaker kind during the growing period of the tree. The remedy should be applied immediately upon the appearance of the fungus, which is first detected upon the young fruit and the developed leaves.

PEACH CRACKING AND LEAF BLIGHT.

Entomosphorium maculatum.

[Figs. 4, 5, and 6, Plate III.]

This disease makes its appearance early in the spring, soon after the development of the leaves.

"It first shows itself in the shape of small, dull carmine red spots, which appear first on the upper, and finally penetrate to the lower surface of the leaf; the color soon changes from red to a dark brown, with a slightly elevated, minute, black spot in the center. The spots also increase in size, and if they are very numerous, as is most often the case, the tissue between them also turns brown and loses its vitality. If the leaf is young or belongs to a delicate leaved variety, it shrivels up by the contraction of the diseased portions; but if it is mature and consists of firm tissue it retains its shape, the only change being in the color. As soon as the leaf becomes badly diseased it falls off; and if, as often happens, another growth of leaves is produced, these too become diseased. The spots are about .11 of an inch in diameter.

"Trees seriously attacked by this disease can be distinguished at a distance by their defoliated appearance. This wholesale destruction of the foliage interferes very seriously with the growth of the wood and the maturing of the fruit, for the leaves are the organs which transform the food material that is brought up from the roots and absorbed from the air into a form in which it can be directly used by the plant in the making of wood and production of sugar in the fruit.

"But, in addition to this, the fruit and stems themselves often become diseased. The fruit also shows the carmine red spots, which afterwards become dark colored. The skin becomes very much roughened, and the growth of the epidermis over the diseased portion is checked, causing a crack which extends deeply into the flesh, so that, even if the fruit can obtain sufficient sugar to mature properly, its appearance is spoiled and the cracking makes it liable to decay.

"The development of the fungus on the branches does not differ materially from what takes place on the leaves. There first appear small circular spots on the young bark; these gradually become elongated and somewhat depressed, with a slight elevation in the center, and their color changes to a brownish black. Frequently the stem is completely girdled by these diseased areas, and, as a result, the end of the branch dies above the point where the fungus is present. The petioles and leaf scales are also often diseased. Indeed, there seems to be no part of the tree above ground, that is in active growth, quite exempt from the attacks of the parasite."—Galloway.

The Winter Nelis pear has suffered the most in this State from the attacks of this fungus. This spring, however, the early pears showed the presence of the disease. Early in June I visited several orchards of early pears, and in some the disease had done considerable damage, especially upon the Dearborn Seedling.

The winter of 1889-90 was an exceedingly wet one; the fungus developed more rapidly than at any previous season, and its arrest proved much more difficult, as men could not be put to work at the proper season, the ground being so wet as to prevent it. The remedies applied late in the season were more or less effective, but the results would have been more satisfactory had they been applied in season to do the most and greatest good.

Remedy.

The Section of Vegetable Pathology at Washington has carried on very extensive investigations on the fungoids that affect the trees on this coast. They have also carried on a series of experiments to arrest the malady, a summary of which is here given, as follows:

"This fungus causes the greatest injury to young trees, and especially those growing in nurseries. Burning the fallen leaves would serve as an important means of removing a source of infection. The best results will follow if the leaves are raked together and destroyed as soon as they fall; in other words, it would not be advisable to allow such leaves as may fall in midsummer from the effects of the malady to remain on the ground under the trees until the following autumn or spring. They should be destroyed as quickly as possible, before any of the spores have had an opportunity to escape.

"The development of the fungus upon the leaves or other parts of the plant may be prevented by the application of some fungicide. Since the spots make their appearance as soon as the leaves have attained full growth, the application must be made early, so as to prevent the spores from germinating. In no case should the application of the remedial agents be postponed until the fungus has made its appearance upon the leaves, for if this is done it will be of little use to apply them.

"Where the disease prevails more or less every year it would be well to thoroughly spray the trees, before the buds begin to swell, with the Bordeaux mixture, prepared as follows:

"Dissolve sixteen pounds of sulphate of copper in twenty gallons of water. In another vessel slake thirty pounds of lime in six gallons of water. When the latter mixture has cooled, pour it slowly into the copper solution, care being taken to mix the fluids by constant stirring.

"When the leaves are about two thirds grown a second application

EXPLANATION OF PLATE III.

FUNGI.

Fig. 1. Shot-hole Fungus (*Septonia cerasina*) on ripe fruit; apricot.
Fig. 2. Leaf and branch affected by the Shot-hole Fungus.
Fig. 3. Shot-hole Fungus, on green fruit.
Fig. 4. Pear leaf, affected by Pear-leaf Blight (*Entomosphorium maculatum*).
Fig. 5. Dearborn Seedling pear, affected by Pear Cracking, or Pear Blight (*Entomosphorium maculatum*); its effects shown on small green fruit.
Fig. 6. The same as Figure 5, illustrating the disease on the ripe pear.
Fig. 7. Red June apple affected by Apple Scab (*Fusicladium dentriticum*), shown on ripe fruit.

FUNGOID DISEASES.

should be made, this time, however, using a solution containing the ingredients in the following proportions:

Sulphate of copper	6 pounds.
Lime	6 pounds.
Water	22 gallons.

"Dissolve the copper in sixteen gallons of water and slake the lime in six gallons, then mix as described above.

"The object of the first spraying is to destroy any spores of the fungus that may have survived the winter in the crevices of the bark, while the second and weaker application is obviously for the purpose of preventing such spores as may fall upon the young leaves from germinating."

The experiments conducted in this State have been with the aim of destroying the scale upon the trees, as well as checking the progress of the fungus, and to this end numerous solutions have been applied. The most successful remedy has been the following:*

Sulphur	3 pounds.
Caustic soda (98 per cent)	2 pounds.
Whale-oil soap	25 pounds.
Solution (in all)	100 gallons.

Boil the sulphur and caustic soda together in about two gallons of water (this is done to allow the caustic soda to dissolve the sulphur). When the sulphur becomes dissolved, add the soap and boil until thoroughly dissolved, then add water to make in all one hundred gallons of solution, and apply warm.

Where the trees are affected with codlin moth, it is well to add Paris green (in the proportions recommended) to the solution, which mixes quite readily and serves two purposes.

APPLE SCAB.

Fusicladium dentriticum.

[Fig. 7, Plate III.]

"The diseases of the apple caused by the fungus parasite *Fusicladium dentriticum*, has long been known to growers of this fruit as 'apple scab.' Less frequently we hear it spoken of as 'black spot,' or simply spot disease of the apple, or, when on the foliage, 'leaf blight' or 'leaf mildew.' It has been known to botanists for a long time and has received many Latin names, but the one here adopted has been generally employed by mycologists since 1869.

"The distribution of this disease is coextensive with the cultivation of the fruit which it attacks, although there may be a few favored localities where it has not appeared. Throughout the Eastern and Central States one is almost certain to find it in every orchard, and on the Pacific Slope, in California, it is also frequent. For more than fifty years it has been known in Europe. It has become a serious pest in Australia, and we now possess reports of its presence in New Zealand."—F. Lamson Scribner, in Report of Department of Agriculture, 1887, p. 341.

The varieties of apples mostly attacked by this fungus in this State

* Somewhat modified from that given on p. 410, report 1885-6.

are the following: White Winter Pearmain, Early Harvest, Baldwin, Red June, etc. Mr. Scribner reports that the following varieties are comparatively exempt from the attack of the fungus: Ben Davis, Winesap, Willow Twig, Jonathan, Smith's Cider, Maiden's Blush, Grimes' Golden, York Imperial, Rhode Island Greening, Sops of Wine, Duchess, and the Russets, but adds that "varieties notably free from the disease in one section, when grown in some other locality more or less remote, may scab badly." He also cites that the Bellflower is nearly free from the scale for unknown reasons.

Conditions Favoring the Development of the Scab.—"The fungus of the apple scab appears to be retarded in its development by the heat of summer. Its most rapid growth takes place during moist, cool weather, such as usually prevails during the early months of spring or autumn. It may be observed that spots, which, during the hot summer months remain brown, at the approach of cool weather assume the olive green, velvety appearance indicating a renewed activity on the part of the fungus. The parasite doubtless retains its vitality throughout the winter, both on the twigs in the orchard and on the fruit which it infests. We have seen specimens of the latter in midwinter in the markets covered with spots on which the fungus was in a most flourishing condition. From the ease with which we know it can be propagated to healthy fruit, and from the appearance of apples in the public markets in the winter and spring months, we believe that the disease may spread after the fruit has been harvested and placed in storage. It is a well known fact that apples, after being gathered and stored, undergo a sweating process, and if healthy and diseased fruits are in contact during this period, infection of the former is very likely to follow.

"It is also well known that the 'scab' fungus is most severe in its attacks in seasons when damp, cold weather prevails at the time the fruit is forming. In the spring of 1885 the young fruit was closely watched for the first appearance of the 'scab' by my assistant. It was noted that at the time the young apples were about the size of peas a period of cold, damp weather set in. In a few days many of the varieties showed plainly the minute black specks which mark the first appearance of the fungus; later, these developed into the well known 'scab' spots. The spring of 1886, in the same locality, was very dry and warm, and there was a marked absence of the Fusicladium.

"The character of the soil appears to have little influence over the disease, although in heavy soils, particularly where the subsoil is wet or poorly drained, it is naturally more prevalent than in light or well drained lands. A damp, cool atmosphere, rather than an excess of moisture with heat, appears to be most favorable for the development of this malady."—Scribner.

The illustration (Fig. 7, Plate III) shows the disease on a Red June apple. Considerable infected fruit has been seen in the markets, and much more than at any previous season.

Remedy.

As yet but few have attempted to destroy the fungus with other remedies than those employed for the destruction of scale insects. Many of these remedies have, however, done much good, and especially where fungicides have been added to the solutions, and where care has been

exercised in not adding any such fungicides that may be destroyed by the action of the other ingredients in the solutions employed. Mr. Scribner says:

The fungus of the apple scab does not penetrate into the tissues of the host, and very early in its development it is wholly exposed to any application which may be made to destroy it. It appears, however, that the vegetative portion or plant body of this, as well as of many other fungi, is very resistant to the action of chemical reagents, quite as much or more so than are the tissues of the leaf or apple upon which it grows. We can scarcely hope, therefore, to accomplish its destruction, unless it be the growths infesting the young shoots and the scales of buds. Before the latter expand in the spring much stronger solutions can be applied than it is possible to use later in the season, and it is at this period that the warfare against this fungus should begin. It has been observed that the germination of the spores is wholly prevented in very dilute solutions of sulphate of copper, and our chief dependence in combating this disease appears to rest upon this fact—the possibility of preventing the germination of the spores where they can do harm. A practical treatment has been discovered by which we may prevent the germination of the spores of the downy mildew of the grapevine by applying various solutions of sulphate of copper to the surfaces of the leaves upon which the spores of the fungus fall. It is doubtless equally practical to accomplish by a similar treatment a like result in the case of the Fusicladium of the apple. Experiments already made with the sulphate of copper solutions indicate that they will, when properly applied, at once check the "scab." Further and more systematically conducted experiments are required in order to determine fully what preparation is most efficacious, at what season it is best to make the applications, and the strength to which the solutions must be limited. Where "eau celeste," prepared according to the original formula, has been tried, it has severely burned and injured the foliage. This preparation may be rendered less caustic by the addition of ordinary carbonate of soda, or by being prepared as follows:

In two gallons of hot water dissolve one pound of sulphate of copper; in another vessel dissolve two pounds of ordinary carbonate of soda; mix the two solutions, and when all reaction has ceased add one and one half pints of liquid ammonia; when desired for use, dilute to twenty-two gallons.

Another and more simple modification of the "eau celeste" is prepared by dissolving in one quart of liquid ammonia four to six ounces of carbonate of copper, then dilute with water to twenty-five gallons. The ammonia and carbonate of copper solution may be kept in a bottle and diluted when required for use at the rate of about one ounce of the solution to the gallon of water. Those who have used this preparation on the grapevine say it is perfectly harmless to the foliage and is as efficacious against mildew as "eau celeste." It is simple and easily prepared, and is very strongly adherent to the foliage.

Simple solutions of sulphate of copper ought not to be employed during the growing season, as their use is almost certain to result in injury to the foliage. The Bordeaux mixture may be used at any time without fear of injury, as follows:

Dissolve sixteen pounds of sulphate of copper in twenty-two gallons of water; in another vessel slake thirty pounds of lime in six gallons of water. When the latter mixture has cooled, it is slowly poured into the copper solution, care being taken to mix the fluids thoroughly by constant stirring. It is well to have this compound prepared some days before it is required for use. It should be well stirred before applying. Some have reduced the ingredients to two pounds of sulphate of copper and two pounds of lime to twenty-two gallons of water, and have obtained good results.

Using one or the other of the above preparations, the following course of treatment is suggested:

First—In early spring, before the buds have commenced to expand, spray the trees thoroughly with a solution of sulphate of iron, using four pounds of the iron sulphate to four gallons of water.

Second—As soon as the fruit has set, apply the Bordeaux mixture or one of the modified preparations of "eau celeste."

Third—If the weather should be such as to favor the development of the "scab" fungus, a third application should be made two or three weeks after the second, using the same materials.

In addition to the effect that these applications may have on the development of the fungus, they will doubtless keep off many pests.

The conclusions reached by Professor Taft (Section of Vegetable Pathology) in his recent experiments, is that the modified "eau celeste" solution gave the best results, and by its use a difference in the amount of scabby fruit of from 50 to 75 per cent was obtained; and adds, that thirty-two gallons of water should be used where the formula calls for twenty-two. The copper carbonate solution tends to give the fruit a russet coloring, but the injury is very slight.

ENTOMOLOGICAL.

BENEFICIAL AND INJURIOUS INSECTS.

THE STRUCTURE, ANATOMY, AND METAMORPHOSES OF INSECTS, AND NAMES APPLIED TO PRINCIPAL ORGANS.

The word "insect" is derived from two Latin words which signify "cut into," or "notched," the bodies of most of the tribe being divided by several incisions, and the parts between those lines or incisions are called "segments." Insects differ from other animals by not breathing through lungs, but through holes, or spiracles, placed at certain distances along each side of their bodies. Their lives are divided into three periods after they have emerged from the egg, the first of which is termed the "larva" state, and is applied to caterpillars, grubs, maggots, as well as to young grasshoppers and bugs before they attain wings. It is principally in this larva state that they do the greatest injury to vegetation, as they eat voraciously, and generally cast their skins several times as they increase in size. After the larva has attained its full size, the second change takes place, when it ceases to eat, casts its skin, and reappears as a "pupa," or "chrysalis," which is in color and outward form entirely unlike the caterpillar, or worm, from which it proceeded. This chrysalis is furnished with the rudiments of legs and wings, but is incapable of locomotion. In this state it does no injury, as it generally remains quiet and motionless, and takes no food whatever. After continuing a certain time in the pupa, or chrysalis state, it again casts its skin and issues forth a perfect and full grown moth, fly, or beetle, to deposit its eggs for future generations. The body of a caterpillar consists of a head and twelve segments, while that of the perfect insect is divided into three parts, the first of which is called the head, the second the thorax, or chest, and the third, the abdomen, or body. The head is furnished with eyes, two jointed horns called "antennæ," which differ greatly in various tribes, and a mouth, formed either for biting, chewing, or sucking. The second part—the thorax, or chest—is furnished either with two or four wings. The legs, generally six in number, are attached to the under side. The abdomen, or hind part, contains the organs of digestion and the piercer, or sting.

It is unnecessary here to enter into details or describe the several grand divisions into which insects are classed. The principal thing desired is to be able to identify the species most injurious and beneficial to cultivated crops; to know their habits, and repel or destroy those which are obnoxious, either in the larva, pupa, or perfect state. Many of the most destructive insects being extremely small and apparently insignificant, the fruit grower can never judge from the size or appearance of any particular species as to its capability of inflicting injury on vegetation.—Browne.

In the chapters that follow, the insects which are among the most important to the fruit grower are illustrated separately, to which is added the best means usually employed for their destruction. The predaceous insects, which are the fruit growers' friends, are also fully illustrated, to which attention is called.

DIRECTIONS FOR COLLECTING, PRESERVING, AND STUDYING INSECTS.

*Apparatus for Collecting Insects.**

One of the first essentials for collecting insects is the net represented in Fig. 16. To make this, obtain an iron wire about one sixeenth of an inch in diameter, and bend it into a circular ring twelve or thirteen inches in diameter, leaving the ends projecting at right angles to the circle, and welding them together so as to form a spur three or four inches

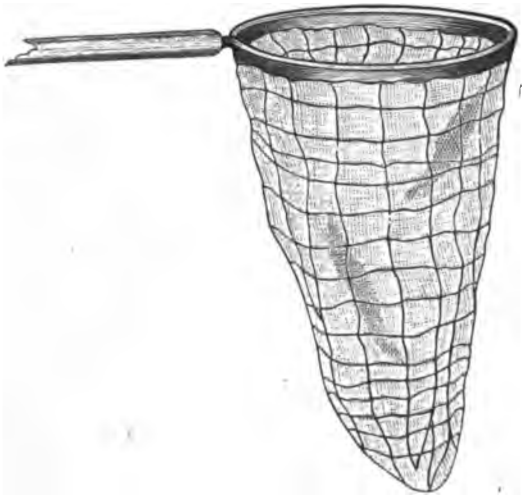


Fig. 16.

long. Fasten this spur into the end of a broomstick, or any convenient handle, three or four feet in length, as shown with handle broken off in Fig. 17. Now, sew over the wire circle a strip of strong muslin an inch or two wide, and to this sew a bag of mosquito netting, Swiss muslin, or some similar fabric, about three feet deep.

* Clarence M. Weed, Entomologist. Bulletin No. 1, Ohio Experimental Station, 1889.

A net for collecting water insects is shown at Fig. 18. It is made shallower than the first, and should be of firmer cloth—coarse millinet answers the purpose very well.

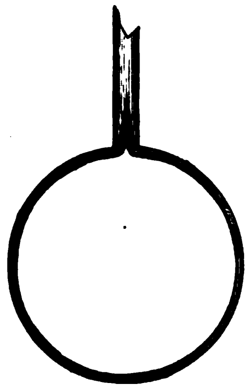


Fig. 17.

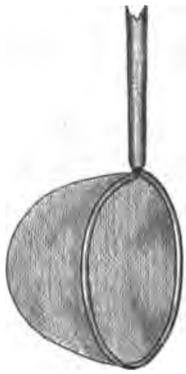


Fig. 18.

Fig. 19.

Another essential is some form of bottle for killing the specimens. The one in almost universal use among entomologists is the "cyanide bottle," represented in Fig. 19. To make this, obtain any wide-mouthed glass bottle, with a tight-fitting cork; place on the bottom two or three lumps of cyanide of potassium the size of a hickory nut; cover these with dry plaster of Paris, and finally add sufficient water to moisten the plaster, and make it "set." After it sets, pour off any surplus water there may be, and let the bottle become thoroughly dry before inserting the cork. In the figure the bottle is represented broken, to show the position of the cyanide, *a*. This cyanide of potassium is a poison, and, of course, must be handled carefully. If desired, the bottles can easily be prepared at drug stores. After the plaster has set, there is practically no danger, unless the fumes of the bottle be directly inhaled, for which there is no excuse. Keep the cork in, and when an insect is caught, simply put it in the bottle. The cyanide fumes rising through the porous plaster will kill it almost instantly. This cyanide bottle is to be used especially for moths, butterflies, bees, wasps, dragonflies, and the like, but should not be used for worms and caterpillars, which are more successfully killed and preserved in alcohol.

A pair of plain forceps like those shown in Fig. 20 will be found convenient for many purposes, especially in collecting small insects.

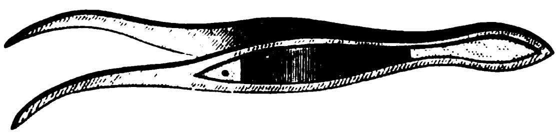


Fig. 20.

A supply of ordinary alcohol, and of various sizes of empty bottles and vials, especially two, three, and four-drachm short homeopathic vials, will be necessary if soft-bodied caterpillars, "thousand-legged

worms," spiders, and the like, are collected. Empty morphine bottles are very convenient.

An ordinary gamebag is an excellent thing for carrying the bottles, forceps, etc., in, while out collecting.

For rearing insects, to study their habits and transformations, breeding cages of various kinds are needed. Almost any box may be used for this purpose, covering it in part with gauze and in part with glass, and placing on the bottom an inch or two of moist earth to prevent the drying of the atmosphere. Ordinary jelly tumblers are very useful for rearing small leaf-eating caterpillars, and "bell glasses," or glass shades, serve an excellent purpose. I have not space to discuss, in this connection, the needs of the various classes of insects to be reared, but in general, it may be said that the cages should be examined daily, the food should be frequently renewed, and the conditions which the insect would have in its native haunt, so far as possible, should be supplied.

Apparatus for Preserving Insects.

The first requisite for preserving insects is a supply of entomological pins. These are longer and more slender than ordinary pins, and answer the purpose much better. They vary in size according to the number. No. 2 is used only for very small insects, and No. 5 is large enough for any of our species. For the majority of specimens of moderate size No. 3 may be used.

A supply of sheet cork is also desirable to place in the bottom of the boxes into which the specimens are pinned.

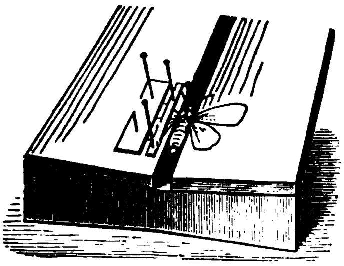


Fig. 21.

Butterflies, moths, and some other insects require, for their proper preservation, what is called a "setting board," one of which is shown in Fig. 21. It consists simply of two thin strips of pine board, twelve or sixteen inches long, nailed to end pieces, with a space varying from one fourth to three fourths of an inch between the long strips; a piece of thin cork is fastened to the under side of the strips so as to cover this space. The pin on which the butterfly is fastened is pushed through the cork until the side pieces are level with the base of the wings. The wings are then brought forward until the posterior borders of the front ones are at right angles to the body, and they are then fastened in place by pieces of cardboard held down with pins, as shown in the illustration. The insect should be left thus fastened until dry, so that the wings will remain in the position indicated. This usually requires ten to fourteen days.

Some sort of boxes or cases in which to keep the specimens are of

course necessary. The cheapest and simplest receptacle consists of empty cigar boxes, lined on the bottom with sheet cork. Tight wooden boxes of almost any kind will also answer the purpose. Shallow drawers, with the bottoms lined with cork, are excellent.

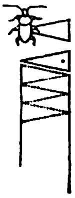


Fig. 22.

The specimens must frequently be examined to see that the museum pests—insects which live on dead animal tissues of all kinds—do not destroy them. When indications of the presence of these are found, the easiest way to kill them is to bake the specimens in an oven for an hour, at a temperature of 140 degrees Fahrenheit; or they may be exposed to the vapor of benzine, bisulphide of carbon, or some similar substance, remembering always that these vapors are explosive, and that fire in any form must not come near them. Napthaline placed in the boxes will also keep the pests away.

It is best to fasten small insects to a narrow triangle of cardboard, about three eighths of an inch long, as shown in Fig. 22. The insect is attached to the pointed end with mucilage, or glue, and a pin is thrust through near the base of the triangle.

Moths, butterflies, bees, wasps, and a large number of similar insects, should be pinned through the center of the thorax, or middle division of the body, the pin being pushed through until about one third of its length remains above the insect. Beetles, however, should be pinned through the right wing cover, as shown in Fig. 23, and the true bugs through the triangular piece at the base of the wings, called the "scutelum," as seen at Fig. 24.

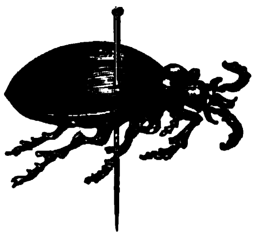


Fig. 23.

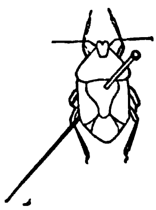


Fig. 24.

Studying Insects.

After a student has collected and prepared his specimens, he will need few directions concerning further study of them. He will have already noticed that there is a great variety of structure among them, and that on the other hand certain species look so much alike that they would naturally be classed together. This will lead to a study of the classification of insects, for which certain books will be necessary.

EMPEROR MOTH.

Platysamia cecropia, Linn.

This is one of our largest moths, the wings when expanded measuring from five to seven inches across. Fig. 25 gives a good representation of the moth. "Both the front and hind wings are of a rich brown, the anterior pair grayish, shaded with red, the posterior more uniformly

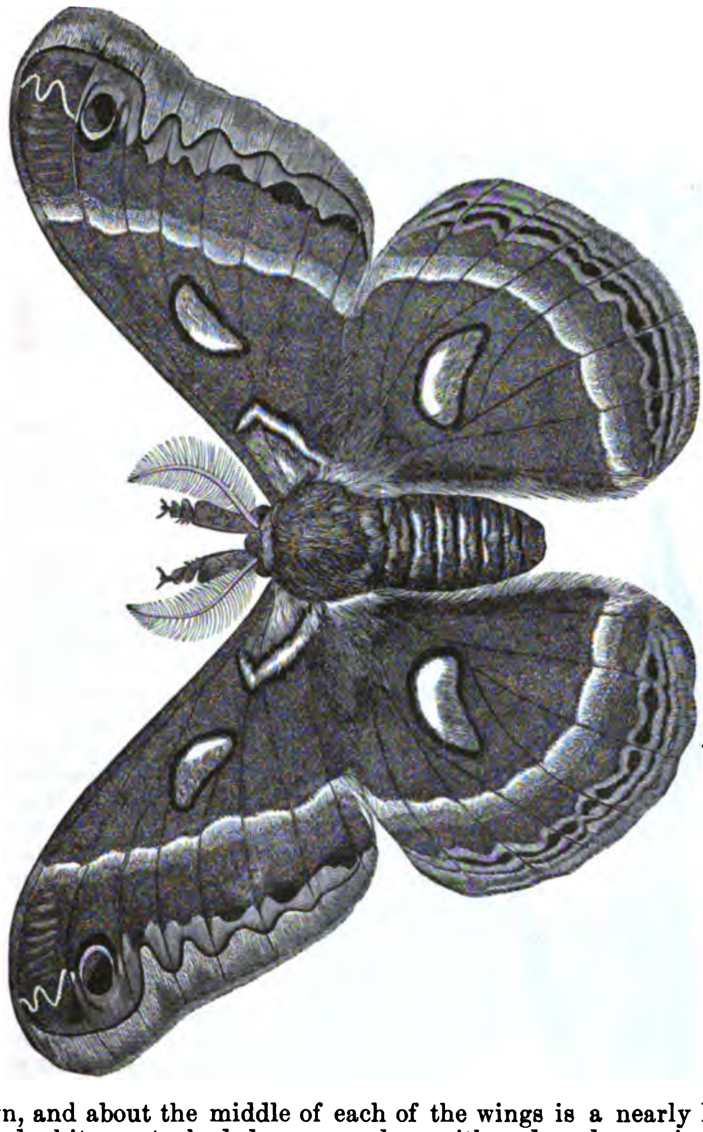


Fig. 25.

brown, and about the middle of each of the wings is a nearly kidney-shaped white spot, shaded more or less with red, and margined with black. A wavy dull red band across each of the wings, edged within with white, the edging wide and distinct on the hind wings and more or less faint on the front pair. The outer edges of the wings are of a pale silky brown, in which on the anterior pair runs an irregular dull black line. The front wings next to the shoulders are dull red, with a curved white and black band, and near their tips is an eye-like spot with a bluish white crescent. The upper side of the body and the legs are dull red, with a wide band behind the head, and the hinder edges of the rings of the abdomen white; the under side of the body is also marked with white."—Saunders.

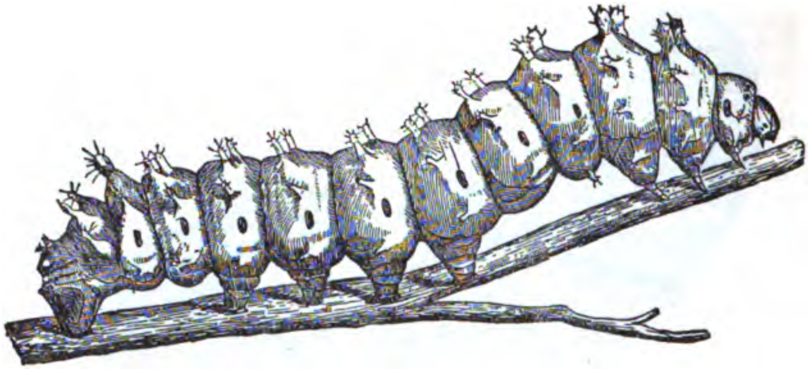


Fig. 26.

The moth lays its eggs usually in pairs, and firmly fastens them with a gummy substance. They generally lay the eggs on the under side of the leaf. When the egg (in about six to ten days) hatches, the young larva gnaws its way out.

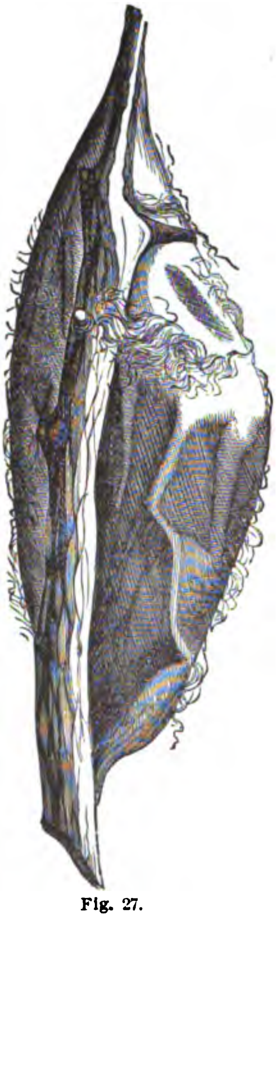


Fig. 27.

At first the young larva (caterpillar) is black, and on its sides are little black knobs, and on these knobs hairs arise of the same color. The growth of the caterpillar is very rapid, and from time to time it throws off its exterior skin. At each change the caterpillar appears in different colors, which it assumes in molting.

The caterpillar (Fig. 26), when full grown, is from three to five and one half inches long, and fully three inches in circumference. The color of the caterpillar is pale green, and the warts, or tubercles, on each side of the body are dark red, with brown and blue intermixed. The tubercles on the back are yellow, except those towards the end of the body, which are about the same color as those along the side. These caterpillars, from the time they hatch until pupation, feed on the foliage of trees during the growing period, sometimes stripping young trees entirely bare. When the caterpillar attains full growth, it forms a cocoon, as shown in Fig. 27, which is about three to four inches long and more than an inch in width, and is of a rusty gray color. This cocoon is formed of two layers of silk. In this cocoon the chrysalis is formed, which is large and of a dark brown color, and remains in the cocoon during the winter months. In the spring (May and June) the moth emerges from the chrysalis to perform its natural functions, but does not attain full growth until a few hours after.

Remedy.

The best remedy is hand picking in the summer, and the gathering and destroying of the cocoons during winter. They are so large that finding them becomes an easy matter.

TOMATO HAWK MOTH.

Macrosila carolina, Linn.

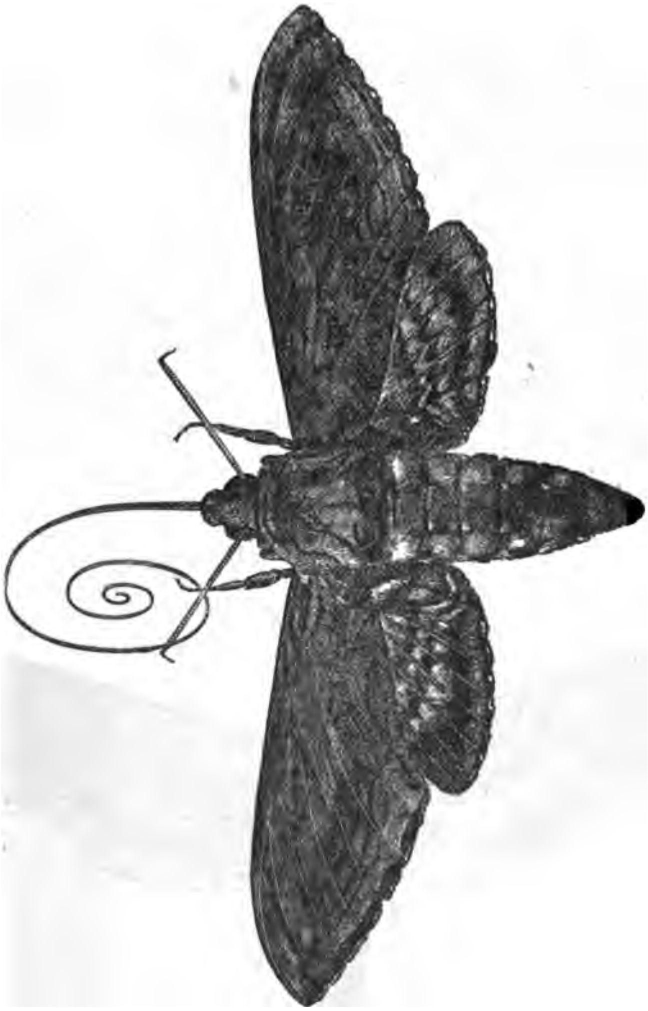


Fig. 28.

This is a very common moth, but does not increase as rapidly as other species do. The wings, when expanded, measure five and one fourth inches across. The head of the moth is quite large, and the wings rather broad, with the interior angles dilated. The hind wings are gray. There are two distinct angulated bands at the base of the fore wings.

The tongue of this moth is very long, in some specimens having measured nine and one fourth inches. The abdomen is marked with pink spots.

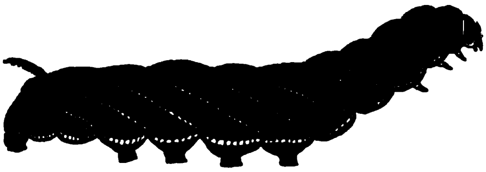


Fig. 28½.

The larva (caterpillar), Fig. 28½, is dark green, and measures from four to five inches in length. On the side of the body is a series of angular bands of greenish yellow. This caterpillar feeds on tomato and tobacco plants, but has also been observed feeding on other plants, as well as on the foliage of the apple, pear, etc.

Remedy.

The best remedy for the destruction of these caterpillars is hand picking. The plants should be looked over from time to time, and all larvæ found destroyed. The caterpillars feed upon the plants voraciously, and in a very short time strip them of their leaves. The caterpillars are so large, and as they consume considerable foliage, their damaging effects are soon observed on the vines; however, it is rarely that more than one or two caterpillars are seen on a vine, and therefore they are easily exterminated.

SPHINX MOTH.

Philampelis pandorus, Hubner.

Fig. 29.

The wings of this moth, when expanded, measure from four to four and a half inches across, and are of a light olive color, intermixed with

gray, and very rich and velvety. The hind wings have a rosy-hued color. The moth makes its appearance in the spring (May and June), and sometimes not before July. The larva at first is of a pinkish hue along the sides; as the caterpillar increases in size it changes to a reddish brown color. The full grown larva (caterpillar) measures about four inches in length (see Fig. 30). The larva, when in motion (as shown at *a*), is much longer than when at rest (as shown at *b*), as when it is at rest the body shortens nearly an inch.

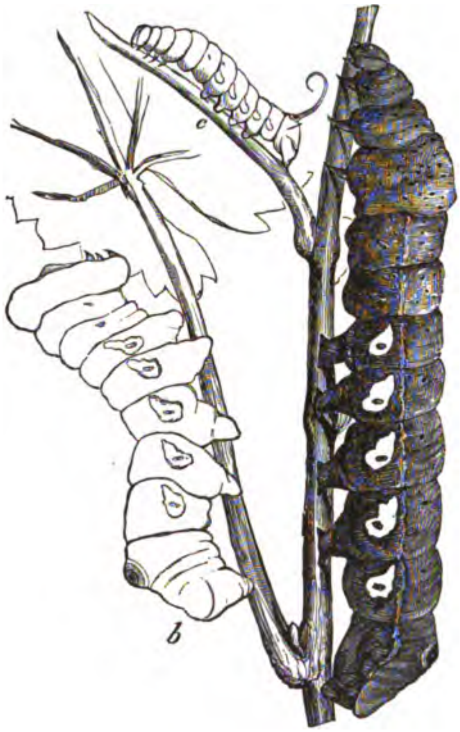


Fig. 30.

[(*a*) Caterpillar full grown; (*b*) Caterpillar nearly full grown; (*c*) Young caterpillar.]

As the larva is very large, it must necessarily feed voraciously upon foliage, and is therefore noticeable. The larva (caterpillar), as soon as it reaches its full growth, descends to the ground to pupate. It buries itself in the ground, where it forms an oval cell and changes within it into a dark brown chrysalis, where it remains in this chrysalis state until the summer following. There is, however, an exception to this rule, as the larva sometimes matures and transforms into a moth the same season.

Remedy.

The best remedy to decrease the progress of this moth is to destroy all caterpillars as they are found. Where the larva becomes troublesome it is well to examine the trees or plants every day, and in this way the damage becomes nominal.

WHITE-LINED SPHINX MOTH.

Deilephila lineata, Fabr.

Fig. 31.

This moth is very common, and is seen everywhere throughout the State. The moth can be seen sometimes flying in the daytime, but only seldom. It is mostly seen and is most active just about sundown, when it may be seen about flowers, resembling in this respect the humming bird. The wings of the moth, when expanded, measure about three and a half inches across. The ground color of the fore wings is a light green color. Along the middle of the wing and near the tip from the base, and along the outer margin, there is a band or stripe of a dark brown color, the veins being marked distinctly with white. The hind wings are quite small and have a wide band across them. This band covers a large portion of the surface of the hind wings. Above and below this band the color is dark brown, almost black. The body is marked with a white line on each side, which extends from the head to the base of the thorax. From the base of the thorax there is another line of the same color, extending down the middle, where it divides and a branch extends to each side. The abdomen is olive green and is spotted with black and white.

Fig. 32.

The larva (caterpillar) of this moth is one of the most common. It is usually found feeding on grape, apple, and pear foliage, and it also feeds on melon and tomato vines. The colors in the larva vary greatly, and for this reason the larva has often been mistaken for that of another species. The most common of these forms is shown in the illustration, Fig. 32. The body is yellowish green, and has a row of prominent spots

along each side. The breathing pores are lower down, and are margined with black and yellow. There is a pale yellow stripe extending down the back. The larva, when it reaches full growth, buries itself in the ground, where it changes into a light brown chrysalis, from which the moth emerges in the fall. These fall moths deposit eggs, from which the second brood of caterpillars are produced. The second brood of larvæ (caterpillars), as soon as they attain full growth, make their way into the ground, and transform into the chrysalis state, from which moths emerge late in fall, or early winter, but generally remain in the ground until spring.

Remedy.

The best and most practical remedy for all these large caterpillars is hand picking. For this purpose old pruning shears are often used; they are cut in two. This avoids the handling of them.

GRAPEVINE SPHINX MOTH.

Ampelophaga myron, Cramer.

Fig. 33.

This is one of the most common of moths found in our State. The moth deposits her eggs on the under side of the leaf. They are generally placed singly, but there is an exception to this rule, as they sometimes appear in groups of two or three.

The young larva (caterpillar) hatches from the egg in four to six days, and at once begins to feed on the foliage, at first attacking the softer portions of the leaves. In passing through its transformations the markings vary considerably at each molt. When full grown the larva is about two inches long, with a rather small head. The head is pale green, and has a pale yellow stripe down each side. The color of the body is green, and is covered with many small yellow dots. When full grown the larva descends from the vine or tree and draws a few leaves together, binding them with a thread, and within this nest changes into the chrysalis. The color of this chrysalis is dark brown, and the chrysalis is generally found at the base of the vine or trees upon which it has fed. Those of the fall remain in this chrysalis through the winter, and emerge into moths the year following, during the months of May and June. Those of the spring, however, emerge as moths in the fall. There are two broods each year.

The wings of the moth (Fig. 33) when expanded measure about two and one half inches across. The wings are long and narrow. The antennæ are of a variety of colors—dull white above, pinkish below;

the body underneath is gray. This is a night-flying moth, and can be seen flying about flowers just about sunset, and is very active.

Remedy.

The caterpillars are quite destructive to the foliage of some trees, vines, and also to garden truck. The only method employed in their destruction is hand picking. They are so large that they can be very easily found, the destroyed foliage generally indicating their presence.

ACHEMON SPHINX MOTH.

Philampelus achemon, Drury.

Fig. 34.

This moth is of a brownish gray color, and has very odd variegations of light brown, pink, and deep brown spots. The color of the hind wings is pink, which become of a deeper red nearer the middle. The body is reddish gray. There are two peculiar triangular patches on the thorax, which are deep brown.

Remedy.

This, like all large caterpillars, can be easily destroyed by hand picking. These caterpillars, however, are not found as numerous as the other species described.

SWALLOW-TAIL BUTTERFLY.

Papilio rutulus, Boisduval.

This is one of the largest of our butterflies, and one of the most handsome of the numerous species that abound in this State. It is very doubtful if many fruit growers ever noticed from which caterpillars these butterflies emerge, of the many they may have found in their orchards. This butterfly makes its appearance generally through the months of May, June, and July. The wings measure, when expanded, about four

Fig. 35.

inches across. The wings are of a very rich pale lemon-yellow color, banded and bordered with black, as shown in the illustration (Fig. 35).

Fig. 36.

The larva (Fig. 36), when full grown, is from one and one half to two inches long, with a rather large reddish brown head. The body is green, and is partly covered with a whitish bloom. When the caterpillar attains full growth, and is about to change into a chrysalis, the color of the body grows gradually darker; it then spins a web of silk, with which it fastens itself onto a limb; it then casts its skin and remains a dull brown chrysalis until the spring following, from which the beautiful butterfly emerges.

Remedy.

The habits of this butterfly are somewhat peculiar, being solitary, and, therefore, the species is not of much importance. The caterpillars, however, feed upon the foliage of the grape, peach, apple, pear, etc. Whenever found they should be destroyed.

YELLOW BEAR MOTH.

Spilosoma virginica, Fabr.

This is one of the most common moths known. The moth is commonly known as the "white miller." The wings of the female moth, when expanded, measure from one and one half to two inches across. The male moths are somewhat smaller. The wings of both sexes are white, and have a few black dots; these, however, vary in number, as

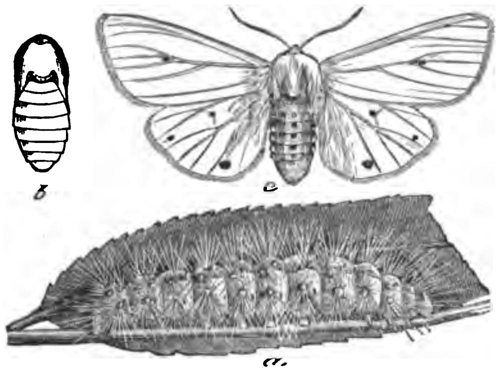


Fig. 37.

[(*a*) Caterpillar (larva); (*b*) Chrysalis; (*c*) Moth.]

upon some there are two on each of the front wings and three on the hinder pair, while in others these spots are wanting, or almost so. There is a dot near the middle of the front wings that is always seen, although at times with much difficulty. The abdomen at the under side is white and tinged a little with orange. The caterpillar (Fig. 37, *a*), when full grown, measures nearly two inches long, and is of a yellowish color, but this, however, varies from light to a dark shade. Upon attaining full growth it seeks some sheltered place, where it transforms to a chrysalis (Fig. 37, *b*) of a dark brown color. They pass through the winter in the chrysalis state, and the moths appear in early spring, when they begin to lay their eggs, which are generally deposited on the under side of the leaf, but sometimes on the bark of trees. The eggs are deposited in large clusters. In a few days the eggs hatch into small hairy caterpillars, which at once begin to feed on the foliage of whatever tree or vine the eggs may have been deposited on. At first the young caterpillars only devour the under side of the leaf, but in a very short time eat freely of all parts of the leaf, their digestive powers having become sufficiently strong to enable them to eat freely, even of most kinds of vegetation.

There are two broods each season, but moths and caterpillars are always found from early spring till late in fall, due to the intermingling of the broods.

Remedy.

These caterpillars are very easily destroyed by the application of Paris green—one pound to one hundred and sixty gallons of water. If they appear on plants or trees at a time when Paris green cannot be used with safety, hand picking should be resorted to.

CURRANT WORM.

Nemantus ribesii, Scopoli.

The larva (Fig. 39) of the currant sawfly (Figs. 38–40) gives at times much trouble to the orchardists, as it makes its appearance on the bushes at a time when they are full of tender foliage, and therefore difficult to treat. The female fly (Fig. 38) deposits her eggs on the under

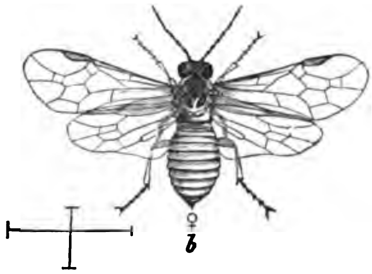


Fig. 38.

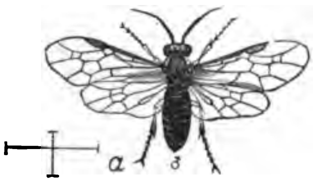


Fig. 40.

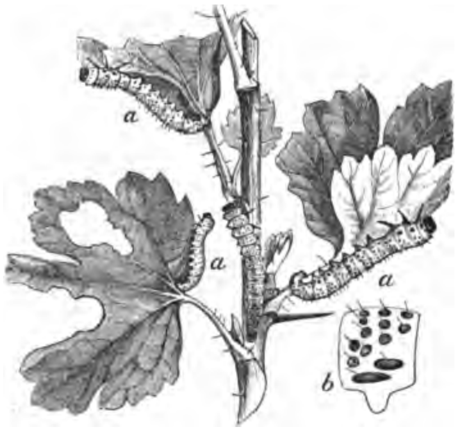


Fig. 39.

side of the leaf, and within eight or ten days the larvæ hatch, and very soon thereafter begin to feed, eating at first small holes in the leaf. They feed in droves of from twenty to fifty or more on a leaf, soon devouring all its soft parts, giving it a skeleton-like appearance. In a very short time the caterpillars increase in size, and assume a dark green color, with numerous black dots, and tinged with yellow; this, however, occurs just before transforming into the chrysalis state. The illustration (Fig. 39) shows the larvæ (caterpillars) in their full growth, and as they are seen feeding upon the leaves of currant and gooseberry bushes. When full grown they are about three fourths of an inch long. When the caterpillars reach full growth they form a cocoon, made among dry leaves, etc., under the bushes on the ground, and sometimes attach themselves to the leaves or twigs. Very soon the caterpillars change into a whitish green chrysalis, which is quite transparent, and from which the fly makes its appearance in early spring, and soon again lays her eggs, which hatch before the end of summer.

Fig. 40 shows the male, and Fig. 38 the female fly, both enlarged. The body of the flies is black, the under side being yellowish, and the legs are bright yellow. The female is larger than the male, and differs somewhat in the color of the body, which is mostly yellow, instead of black.

Remedy.

The remedy mostly used for the destruction of the caterpillars is powdered hellebore—one ounce to five gallons of water—sprayed on the bushes. This will not injure the bushes or tender foliage.

Paris green *should not* be used on currant or gooseberry bushes, unless after the gathering of the berries, when it can be applied successfully; one pound to two hundred gallons of water.

CURRANT SPAN WORM.

Eufitchia ribearia, Fitch.

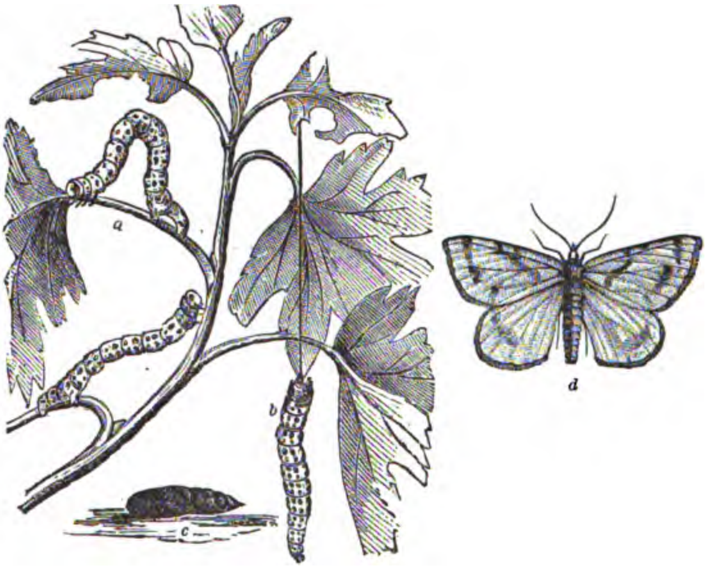


Fig. 41.

[(*a*) and (*b*) Larva; (*c*) Chrysalis; (*d*) Moth.]

This caterpillar may be easily distinguished from the sawfly larva (*Nemantus ribesii* and of *Pristiphora grossulariæ*), especially by its mode of progression. At every step it arches its body into a loop, as shown in the illustration. When full grown the larva (caterpillar) measures an inch to an inch and a quarter in length. The larva is of a whitish color, and has a wide yellow stripe down its back. There is another yellow stripe along each side of the body and numerous black spots. The eggs are laid in autumn, and remain attached to the limbs or twigs until spring, hatching about the time the bushes are in full leaf. The larvæ (caterpillars) attain their full growth in about three or four weeks. When they reach full growth they descend to the ground and transform into a dark brown chrysalis, and from which the moth emerges in about three or four weeks. The moth (Fig. 41, *d*) is of a pale yellow color, and has several dusky spots; these, however, vary greatly in size and form. The wings of the moth when expanded measure about an inch and a quarter across.

Remedy.

Paris green is the most effectual remedy—one pound to two hundred gallons of water, and even stronger, but under no circumstances should this be applied until after the crop has been gathered. Powdered hellebore is a certain remedy, but must be used strong, as the caterpillars are quite difficult to destroy, therefore it should be used on these caterpillars at least double the strength as used for other sawfly caterpillars. Buhach is also effectual, one half of a pound to ten gallons of water. Buhach and hellebore can be applied on tender foliage without danger.

NOTODONTA MOTH (RED-HUMPED CATERPILLAR).

Œdemasia concinna, Smith.

Fig. 42.

[(*a*) Moth; (*b*) Caterpillar.]

"Different broods of caterpillars of this moth make their appearance at various times during August and September. The eggs from which they proceed are laid in the course of the month of July, in clusters, on the under side of a leaf, generally near the end of a branch. When first hatched, they eat only the substance of the under side of the leaf, leaving the skin of the upper side and all the veins untouched; but as they grow larger and stronger, they devour whole leaves from the point of the stock, and go from leaf to leaf down to the twigs and branches. The young caterpillars are lighter colored than the older ones, which are yellowish brown, paler on the sides, and longitudinally striped with slender black lines; the head is red; on the top of the fourth ring there is a bunch or hump, also of red color; along the back are several short black princkles, and the hinder extremity tapers somewhat, and is always elevated at an angle with the rest of the body when the insect is not crawling. The full grown caterpillars measure one inch and a quarter, or rather more, in length. They rest close together on the twigs when not eating, and sometimes entirely cover the small twigs and ends of the branches. The early broods come to their growth and leave the trees by the middle of August, and the others between this time and the latter part of September. All the caterpillars of the same brood descend at one time, and disappear in the night. They conceal themselves under leaves, or just beneath the surface of the soil, and make their cocoons. They remain a long time in their cocoons before changing to chrysalids, and are transformed into moths towards the end of June or the beginning of July."—Dr. Harris.

This caterpillar is mostly to be found in prune and apple orchards, and is quite troublesome.

Remedy.

The best remedies for the destruction of these caterpillars are hand picking and Paris green. Upon jarring the branches all the large caterpillars fall to the ground, and should be thrown into a strong caustic soda solution, which kills them instantly.

In the bucket containing the caustic soda solution, a wire basket is arranged, which fits closely down to the bottom of the bucket. Before moving to another tree, this basket is raised up and its contents (caterpillars) thrown away. In this manner the liquid does not require to be renewed often. Spraying with Paris green will kill all the young caterpillars on the tree. The proportions used are one pound of Paris green to two hundred gallons of water. Great care must be exercised in the use of Paris green. It should only be used when the fruit is still green.

FALL CANKER-WORM MOTH.

Anisopteryx autumnata, Packard.

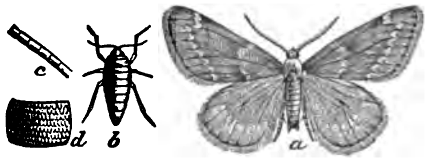


Fig. 43.

The female moth (Fig. 43, *b*) of this species is *wingless*, and in its movements quite sluggish. The body of the female is of a shining ashy color above, and gray beneath. It measures about four tenths of an inch in length.

The male moth (Fig. 43, *a*) is of a brownish gray color, and quite glossy. The fore wings are of a light brownish gray color, and are crossed by two quite irregular white bands, the outer one quite prominent near the apex, where a large pale spot is found. The hind wings are grayish brown, with quite distinct whitish band crossing them, as shown in the illustration. The eggs are laid side by side in regular masses. These egg masses are placed on branches or trunks of trees. In a very short time they hatch, but generally just about when the apple trees begin to bud out. The young larvæ cluster upon and eat the tender leaves. The newly hatched larva is of a pale olive green color. When full grown, it measures about an inch in length.

These caterpillars are often called "loopers," because they extend their body, and loop when traveling. These caterpillars are also given the name of "measuring worms." The larvæ, when full grown, leave the trees by letting themselves down by silken threads, or by creeping down the trunk. When they reach the ground, they burrow from two to six inches into the earth, where they transform into the chrysalis of about one half of an inch long, and of a light gray-brown color. The chrysalis of the male is slender, and is furnished with wing cases. The chrysalis of the female is much larger, and is without wing cases. They remain in the ground until autumn, when the moths emerge, and very soon thereafter begin to perform their functions.

Remedy.

The caterpillars are easily destroyed by the application of Paris green, one pound to two hundred gallons of water, but should be applied only when the fruit is quite small. The females being without wings, can be prevented from ascending the trees by placing on the trunk of the trees bands made of tarred paper, on which substances like printers' ink, slow drying varnish, etc., are smeared from time to time. In ascending the tree the legs of the female become entangled and she soon dies. The tin band tree protector (Fig. 44) has been used successfully in preventing the ascent of the moth.

This protector is made and placed on the tree as follows: Take a strip of tin four inches wide, of sufficient length when encircling the tree to leave a space of about six inches. The upper edge of the tin is bent over so as to receive beneath it a piece of muslin as long as the tin and

Fig. 44.

eight inches wide, to be held in place by pounding down the tin. The ends of the tin are bent in opposite directions, so that they can be hooked together. Placing this around the tree with the cloth upward, the cloth is to be firmly bound to the tree by a strong cord. In the above method, the insects, which will collect in large numbers below the obstruction, may be easily killed by brushing them with kerosene oil, without injury to the tree, unless an excessive quantity (a very little is needed) should be used.

SPRING CANKER-WORM MOTH.

Anisopteryx vernata, Peck.

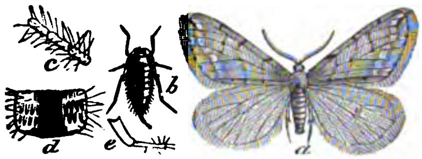


Fig. 45.

The female moth of this species, like that of *Anisopteryx autumnata*, is wingless, and differs from it very slightly. The moths lay their eggs in early spring, or about the time the apple tree begins to put forth its leaves, upon which the larvæ feed. The larvæ eat nearly all the pulpy part of the leaves and leave only the veins and midrib. They differ in color at different ages. This difference is also observed among those of the same size and age. When fully grown they assume an ash color on the back, and black on the side, and a yellowish line below. The larvæ on reaching maturity quit their feeding place, and some creep down, but the majority let themselves down by their threads, and, after reaching the ground, they burrow into and conceal themselves in the earth and transform into a light brown chrysalis.

BROAD—NECK BORER.

Prionus laticollis, Drury.

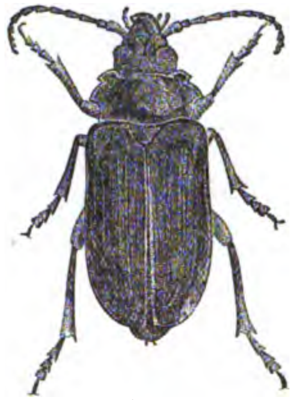


Fig. 46.

This gigantic beetle appears during July and August, but at times has been seen much earlier, and also late in winter. The beetle measures from one inch and a quarter to two inches in length. The color is dark brown, nearly black. The beetles possess strong, thick jaws. In the male the antennæ are rather slender (see illustration, Fig. 46, the male insect), as also the body. In the female the body is much broader and the antennæ not so stout. The larva (Fig. 47) is a large borer, with a broad neck. It measures from two and a half to three inches in length. The color of the larva is yellowish white.

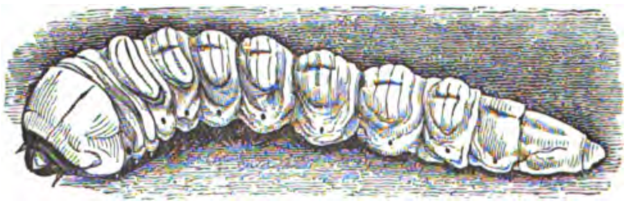


Fig. 47.

The head is quite small, and is reddish brown. There is a light blue line down the back. It always attacks the trees or vines just below the surface. It bores a hole through the center of the root or into the trunk. On the trunks of trees or vines it never bores very deep, seemingly preferring to work just under the bark. The larvæ cannot easily be discovered, for the reason that the trees do not begin to show the effects until the larva has had time to develop to its full size, when it becomes a voracious feeder. The larva remains in that state three days, and changes to the chrysalis state about the month of June, as the beetles generally make their appearance in July.

Remedy.

It is very difficult to ascertain the presence of underground borers before the trees indicate their presence. Walnut and apple trees sometimes are observed to be bleeding (oozing sap) from a certain spot; this indicates a borer, or having been damaged otherwise. However, the cause should be carefully looked into by cutting into the bark, and the borer be destroyed. The wound should then be covered over with such material that will prevent the action of the atmosphere from injuring the tree. This borer attacks walnut trees, and they are often detected by the oozing of sap.

TWO-STRIPED APPLE BORER.

Saperda candida, Fabricius.

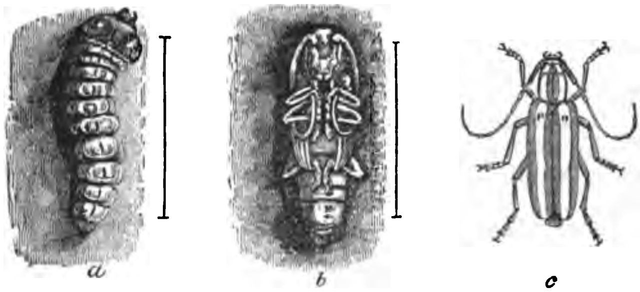


Fig. 48.

This borer in its perfect state is a very handsome beetle (Fig. 48, *c*), and is about three fourths of an inch long and cylindrical in form. In color it is pale yellow, and has two broad, creamy white stripes running down its back, the whole length of the body. The antennæ and legs are gray. The females have a shorter antennæ and are larger than the male. The beetles lay their eggs in the spring of the year and generally on the body of the tree near the ground, and within two or three weeks the eggs hatch. The young larvæ at once commence to bore with their sharp mandibles into the body of the tree, and as they increase in growth, to the interior of the tree.

It takes the larva (Fig. 48, *a*) about three years to reach maturity. The presence of this borer is detected by the bark oozing sap (a dark colored liquid), which generally runs down the trunks of trees. The part from where the oozing starts should be examined by cutting the bark and following their cavities until the borer is reached. When the larva reaches maturity it sheds its skin and transforms into the chrysalis state, in which condition it remains from ten to twenty days, and then emerges into a perfect beetle. The larvæ in many instances cause the death of trees by completely girdling them.

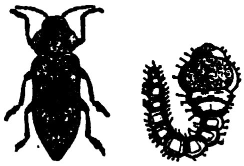
Remedy.

The borers may sometimes be reached by thrusting a stout wire into the holes and the destruction accomplished by turning the wire around several times. The trees should be looked over from time to time, and

all borers found destroyed. Preventive measures may be employed, such as wrapping the trunk of the trees with tarred paper, or by giving the trunks a coating of soap (such as laundry or whale oil) and sulphur, such being repulsive to the insect, which will not lay its eggs on trees thus protected.

FLAT-HEAD APPLE BORER.

Chrysobothris femorata, Fabricius.



a b

Fig. 49.

The beetle (Fig. 49, *a*, enlarged) measures about three eighths of an inch in length; it is of a flattish oblong form, and of a greenish black color. The under side of the body and the legs have a copper shining appearance, and the feet are shining green. This borer does not confine its attacks to the trunk of the tree, but also attacks the larger branches.

The larvæ (Fig. 49, *b*) sometimes girdle a small tree in a very short time, and a single larva often causes the death of a tree. When mature, the larva (Fig. 49, *b*) changes to a chrysalis, which is at first white, but soon assumes the color of the beetle, which emerges in about twenty days.

Remedy.

Old, healthy trees do not suffer as much from the attacks of this borer as the young trees, and especially sickly trees. They generally attack a tree when injured by exposure to the sun.

The borers can be detected by the discoloration of the bark, which assumes a dried appearance, or by the oozing of sap and sawdust-like castings. Whenever any such indications are seen they should be carefully looked into, by cutting the bark at the part affected, and the borer, if found, destroyed. It is also well to guard the trees from sunburn by wrapping the trunks with tarred paper, or any common wrapping material, such as old newspapers, old sacks, etc., or by placing a shake on the south and west sides of the trees. Whitewashing the trunks of the trees is also effective, but the whitewash should contain, in addition to the lime, a few pounds of laundry or hard soap of any kind, and some sulphur. The soap will cause it to adhere to the body of the tree, and combined soap and sulphur give offensive odors, which are repulsive to the insect, and prevent it from depositing eggs upon the bark.

MAY BEETLE.

Lachnosterna fusca, Frohl.

This beetle makes its appearance early in May and June, flying mostly just about sunset; they remain in repose during the day. It is of a brown color, varying from light brown to nearly black. The beetle

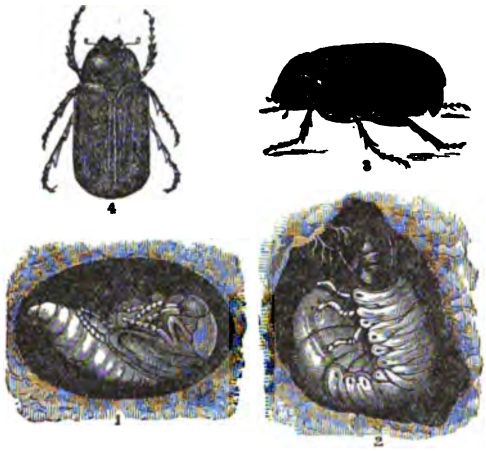


Fig. 50.

is about an inch long, and has a rather thick body. The thorax is punctured with small indentions. The wing covers are glossy and shining. The female beetle lays her eggs in the ground, and when hatched, the larva (a small, white grub) begins to feed upon the small plant roots. The larva is said to be several years in reaching maturity, therefore larvæ of different sizes are often found.

The larva (Fig. 50, *2*) is commonly known as the "white grub." They feed upon the roots of strawberries and other small plants, to which they are very injurious. The larva, when full grown, buries itself in the ground and remains there until spring. When ready to transform, the larva forms a cavity in the ground, which it lines with a glutinous secretion, and within it transforms into the pupa state, from which the beetle finally emerges.

Remedy.

The larva of this beetle is very difficult to destroy, as it lives in the ground, and we have to rely upon their destruction by domestic fowls and insectivorous birds. They, however, are not abundant, on account of the length of time required for the larva to reach maturity.

SPOTTED PELIDNOTA.

Pelidnota punctata, Linn.

This beetle resembles the May beetle (*Lachnosterna fusca*) in general appearances, excepting that its wing covers are spotted. The beetle measures about an inch in length, and is of an oval form, and of a dull yellow color. There are three black spots on each wing cover. There is also a small black dot on each side. The gauzy wings concealed under the wing covers are dark brown. The under side of the beetle is dark green. The larva, when full grown, measures nearly two inches in length, and presents the appearance as shown in the illustration, at *a*. This larva also resembles the larva of the May beetle. When it reaches full growth it forms a slight cocoon, in which it changes into

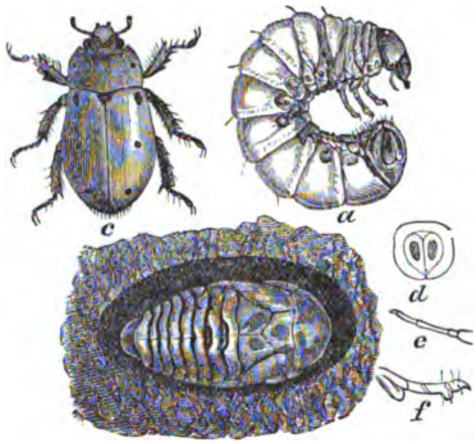


Fig. 51.

the chrysalis state. The beetles make their appearance in the spring, and are quite active during the day, and also fly at night.

Remedy.

For remedy, see remedy for May beetle (*Lachnosterna fusca*).

GRAPEVINE FLEA BEETLE.

Haltica chalybea, Illiger.

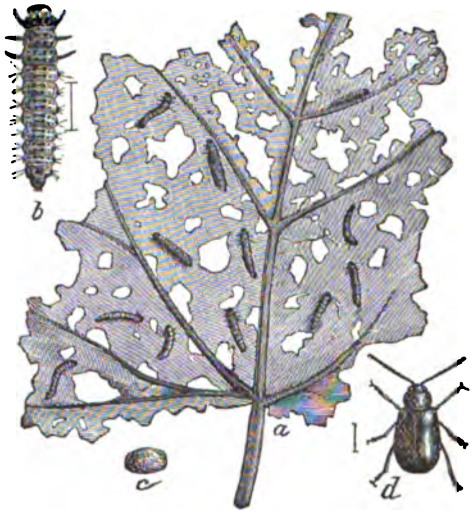


Fig. 52.

This beetle may be seen in early spring feeding on grapevines, and on various kinds of vegetables. It is very injurious to young plants, destroying their foliage. The beetle (Fig. 52, *d*) is about a quarter of an inch

long, and of a deep steel blue color; this coloring shade varies, however, as specimens are often seen on the same plant of dark purple, deep green, greenish blue, etc. Perhaps the tint most common is a glossy, deep greenish blue. The antennæ and feet are dull black. The body is oval, and the under side dark green. The beetles, when disturbed, jump rather than fly. The larva (Fig. 52, *b*) is about thirty-five hundredths of an inch in length, and is yellowish white (cylindrical), with a jet black head and black tubercles; on each side of the body there is a row of dot-like tubercles.

Remedy.

Paris green is the most effectual remedy; one pound to two hundred gallons of water; but should not be used on vegetables under any circumstances, or on fruit trees of very early ripening, unless after the fruit has been picked. Strong tobacco water is also very effectual in destroying the larvæ. Pulverized sulphur and lime (equal proportions) dusted over the plants drives away the beetles.

THREE-STRIPED SQUASH BEETLE.*

Diabrotica trivittata, Mann.

[Fig. 17, Plate IV.]

This insect is quite troublesome, not only to squash and cucumber vines, but also to trees, vines, and garden plants. In the larva state it bores into the lower part of the stem of tender vines. The beetle feeds on the leaves of plants, and also on the foliage of trees.

The beetle generally makes its appearance very early in the spring, in fact, it is wonderful that it seems to know just when the young leaves of vines are fairly above ground. When they infest very young plants, and after they have partially or wholly devoured the leaf, they follow the stem, eating it quite a way below the surface.

Remedy.

The best method for the destruction of the beetles is the application of a solution of Paris green—one pound to two hundred gallons of water. This application does not kill by contact, but by remaining on the leaves the beetles are poisoned while feeding upon them.

Paris green and sulphur—five ounces of the former to twenty pounds of the latter—have been used on the foliage of trees very successfully. The sulphur and Paris green are put into a sack, and the sack is tied to a long pole and shook over the trees. One application has driven away the beetles. This remedy should only be applied when the fruit is young.

SPOTTED DIABROTICA.*

Diabrotica soror, Le Conte.

[Fig. 16, Plate IV.]

Like the preceding one, this insect is very common throughout the State. In places the cherry trees suffer greatly from their attacks. They feed on nearly all kinds of vegetation, but prefer that which is

* Often mistaken for species of ladybird (*Coccinellidæ*).

soft and tender. They are mostly destructive to squash and melon vines, cucumber, and other soft-wooded plants. They are also destructive to corn and beans, by feeding on the tender leaves. The beetle is yellow, with twelve black spots, as represented in the illustration (Fig. 16, Plate IV).

Remedy.

Spray foliage with one pound of Paris green to two hundred gallons of water when the insects appear. (See remedy for *D. trivittata.*)

EXCLUDING SQUASH AND CUCUMBER BEETLES—MECHANICAL BARRIERS.*

A number of methods of fencing out the beetles with mechanical barriers were tested with very satisfactory results. One of the simplest and most successful methods is that of placing the ends of half a barrel hoop in the earth at the sides of the hill, and then laying over it a square strip of thin plant cloth or cheese cloth. The edges of the cloth are then drawn taut, and covered with loose earth or small stones, as shown in Fig. 53. This excludes the beetles, and at the same time allows access of air, moisture, and sunshine. Squash plants are able to grow until they get four or five leaves, and cucumbers and melons even more, before they are crippled by contact with the cloth.

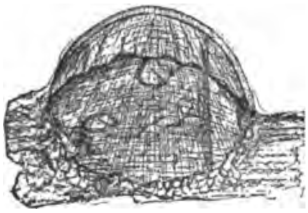


Fig. 53.

Instead of a barrel hoop, a wire may be used. On some of the hills a wire was used, bent as shown in Fig. 54, with excellent results. Another way is shown in Fig. 55, consisting simply of two pieces of wire bent over each other in the middle like the center arch of a croquet ground. Of course, the ends are pushed into the soil and the cloth

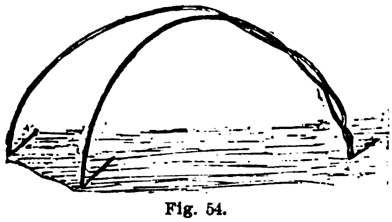


Fig. 54.

drawn over and held down by loose earth as described above. Good results were also obtained by simply placing the cloth over the plants without any standard, and covering the edges as above. By loosening the cloth occasionally it will not cripple the plants.

* Prof. Clarence M. Weed, Entomologist, Ohio Experiment Station.

We also tried various forms of gauze-covered boxes, one of which is shown at Fig. 56. These have, however, the decided disadvantage of

Fig. 55.

Fig. 56.

not allowing free access of air and sunshine, so that the plants are liable to be slender and weak, falling an easy prey to the voracious beetles after the protection is removed.

Summary.

1. The present article embodies the results of the first season's work on a series of experiments undertaken to determine the preventive or remedial value of various methods recommended to prevent the injuries of the beetle.

2. These methods are, for sake of convenience, divided into four classes, viz.: (1) The use of offensive odors; (2) Mechanical coatings of the leaves; (3) Poisonous coatings of the leaves; (4) Inclosing plants under tents or gauze-covered frames.

3. The experiments were made on a large scale, under ordinary field conditions, during the summer of 1889, when the beetles were exceedingly abundant.

4. Five substances of the first class were tested, viz.: hen manure, cow manure, kerosene, carbolic acid, and bisulphide of carbon. None of these proved practically successful.

5. Three substances of the second class were tested, viz.: coal soot, gypsum, and saltpetre. Of these, coal soot and saltpetre proved worthless, while gypsum showed some beneficial effect, not sufficient, however, wholly to save the plants.

6. Three substances of the third class were applied, viz.: pyrethum, slug-shot, and peroxide of silicates. Pyrethum killed those beetles with which it came in contact, when first applied, but soon lost its efficiency. Slug-shot injured the plants to which it was applied. Peroxide of silicates had a decided effect in preventing injury, and where the plants had been well started before being attacked saved them from destruction. But it did not save them where the beetles were so numerous that they burrowed down to meet the sprouting plants.

7. The results obtained from the fourth method—that of fencing out the insects by covering the plants with some form of tent or gauze-covered frame—were by far the most satisfactory. The cheapest and most successful method employed is that of protecting each hill by a piece of plant cloth or cheese cloth about two feet square. This may be done simply by placing it over the plants, and fastening the edges down by small stones or loose earth. It is better, however, to hold it up by means of a half barrel hoop or a wire bent in the form of a croquet arch.

EASTERN PLUM CURCULIO.

Conotrachelus nenuphar, Herbst.

[Fig. 18, Plate IV.]

This insect, which is illustrated in its natural size and color, is perhaps the worst enemy to fruit culture, especially to the plum, apricot, and cherry crops. In the Eastern States the growing of the apricot (although only grown in few districts) has been abandoned in many districts, as the ravages of the curculio are so great as to render its culture an entire failure. The growing of the plum and cherry is also quite difficult, having to resort to heroic treatment in order to produce a crop. It will be readily understood, then, how careful every one should be to avoid the introduction of the plum curculio into this State. A year ago it was rumored that it had made its appearance in this State. Officers were at once detailed to investigate, and the report of its appearance in this State proved to be without foundation.

There are several beetles on this coast that resemble the plum curculio, but before they are pronounced the same they should be thoroughly investigated, and reports should not be put afloat without any foundation of fact. "This insect has not yet been found, so far as we know, in California, or elsewhere on the Pacific Coast."*

The attacks of the curculio are not altogether confined to the fruits above mentioned; they attack peaches and nectarines, and, according to the reports from the East, they also attack the persimmon and several varieties of apples, such as crabs and haws. (See Report for 1889, State Board of Horticulture, page 224.)

Description.

In place of a description, I append the following extract from the report of the Department of Agriculture for 1888:

The Egg.—Having taken a strong hold on the fruit, the female makes a minute cut with the jaws, which are at the end of her snout, just through the skin of the fruit, and then runs the snout under the skin to the depth of one sixteenth of an inch, and moves it back and forth until the cavity is large enough to receive the egg it is to retain. She next changes her position, and drops an egg into the mouth of the cut; then, veering round again, she pushes it by means of her snout to the end of the passage, and afterwards cuts the crescent in front of the hole so as to undermine the egg and leave it in a sort of flap; her object apparently being to deaden this flap so as to prevent the growing fruit from crushing the egg, though Dr. Hull informs me that he has repeatedly removed the insect as soon as the egg was deposited and before the flap was made, and the egg hatched and the young penetrated the fruit in every instance. The beetle first makes a small crescent-shaped incision, with its snout, in the skin of the plum, and then, turning round, inserts an egg in the wound. The egg will hatch in from three to ten days, depending upon the weather, and, as the period of oviposition frequently extends over two months, a confusion of stages arises.

The Larva.—The larva of the plum curculio is white and footless, and furnished with a horny head. It works its way, immediately after hatching, in stone fruit to the pit, and there grows to full size, eating the pulp around the stone. The larva attains its full growth in from three to five weeks, when it is about 10 mm. (0.4 inch) in length, rather stout, and of a glistening whitish color. The head is light brown, and there is a pale line along each side of the body. There is a row of small black bristles below the side lines, and on the second segment a less distinct row of bristles above; also a few pale hairs near the anal end of the body. The fruit thus infested falls prematurely, in a large majority of cases, with plums, apricots, and peaches; cherries, however, do not fall, but remain upon the tree. One or two varieties, particularly the English Morello, are said, however, to mature and drop. In cherries seldom more than one larva is found in a single fruit, but several are often found in a single plum, peach, or apple. Rarely are as

* Report U. S. Department of Agriculture, 1888.

many larvæ found in the fruit as there are punctures under the skin, and many eggs, therefore, fail to hatch. After the fruit has fallen to the ground the larvæ may still remain within it for some time, but as soon as they are full grown they issue and enter the ground to pupate. Larvæ issuing from cherries drop to the ground for the same purpose. They seldom burrow to a greater depth than four or five inches, and at the end of the burrow they construct a small oval cell within which to pupate.

The Pupa.—The pupa is white at first, becoming yellowish as it grows older. It remains in this condition from three to six weeks.

The Adult.—The beetle is familiar to most fruit growers, and is, besides, so well shown in Fig. 18, Pl. IV, that a detailed description is unnecessary. While the females lay their eggs chiefly during the daytime, the insect is essentially nocturnal, flying freely during the warmer nights and only seeking shelter when the nights are cold.

BENEFICIAL INSECTS.

Nearly all of the species of ladybirds (*Coccinellidæ*) are beneficial, and most of them are great enemies to all kinds of injurious insects, and especially to aphis and scale. Sometimes it happens that the scale gets ahead of the ladybirds, and remedies have to be applied, and in so doing many of these friends are destroyed; and where the remedies do not affect the ladybirds the odor is so offensive as to drive the ladybirds away, as they are no doubt guided largely by the odor in the quest for their prey.

Those who find it difficult to determine in the mass of debris on a tree whether there are more dead scales than live ones, and by this reason are led to believe that the benefit derived from the ladybirds is but little, should watch the ladybirds in their search, and no doubt they will find that they pass by dead scales, and only stop to devour live ones. When the scales are thick on a tree they should be sprayed, and in so doing of course the food supply for the ladybirds is reduced and causes them to search more closely. Both the beetle and its larvæ are always active in searching for scales to eat; if they are seen to stop when moving actively, it is an indication that they are feeding.

In pruning an orchard the greatest care should be exercised that the brush be not burned before the ladybirds have again ascended the trees. The prunings (especially of orange trees) should be left a few days to wither, and by so doing the ladybirds and other predaceous insects will fly back onto the trees. When the ladybirds have had time to emigrate, the brush should be burned.

CALIFORNIA LADYBIRD.

Coccinella transversoguttata, var. *Californica*, Mann.

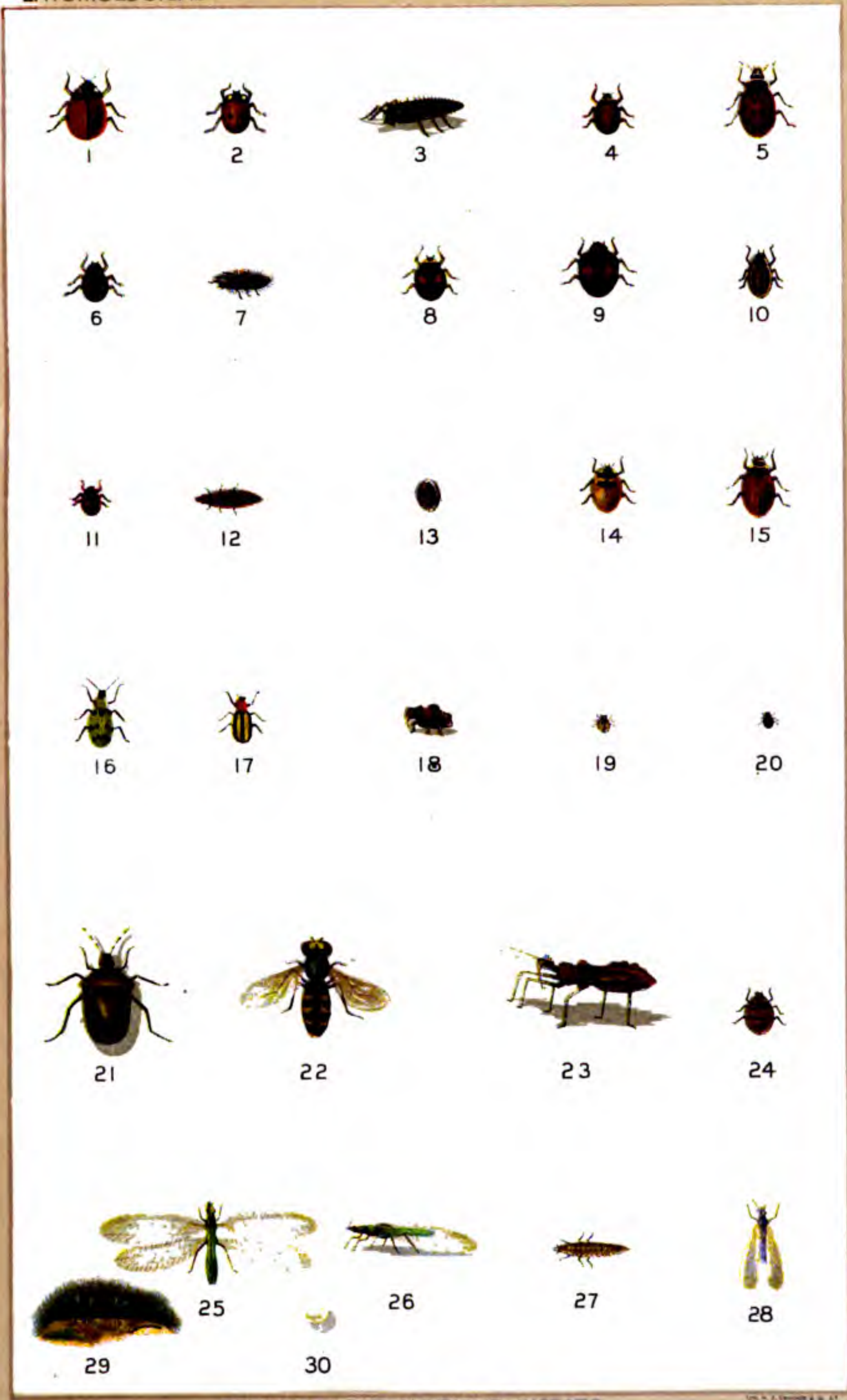
[Fig. 1, Plate IV.]

This ladybird is a California variety, and is a form with no spots. The wing covers are of pale orange color, the thorax is black, and has on each side a pale spot. This is a very common species, and the beetles at times have been found feeding on ripe fruit, but only that which had fallen and was partly broken or bird-eaten. The fact that it has been found feeding on ripe fruit has caused many to believe that it is injurious, but such is not the case. The larva is highly beneficial, and is always found where aphis abounds.

EXPLANATION OF PLATE IV.

ENTOMOLOGICAL.

Fig. 1. California ladybird (*Coccinella transversoguttata*).
Fig. 2. Two-spotted ladybird (*Adalia bipunctata*).
Fig. 3. Two-spotted ladybird, larva (*Adalia bipunctata*).
Fig. 4. Blood-red ladybird (*Coccinella sanguinea*).
Fig. 5. Convergent ladybird (*Hippodamia convergens*).
Fig. 6. Twice-stabbed ladybird (*Chilocorus bivulnerus*).
Fig. 7. Twice-stabbed ladybird, larva (*Chilocorus bivulnerus*).
Fig. 8. Eyed ladybird (*Coccinella oculata*).
Fig. 9. Pilate's ladybird (*Exochomus Pilatei*).
Fig. 10. Striped ladybird (*Megilla vittigera*).
Fig. 11. Australian ladybird (*Vedalia cardinalis*).
Fig. 12. Australian ladybird, larva (*Vedalia cardinalis*).
Fig. 13. Australian ladybird, pupa (*Vedalia cardinalis*).
Fig. 14. Julian's ladybird (*Coccinella trifasciata*).
Fig. 15. Ambiguous ladybird (*Hippodamia ambigua*).
Fig. 16. Spotted diabrotica (*Diabrotica soror*).
Fig. 17. Striped squash beetle (*Diabrotica trivittata*).
Fig. 18. Eastern plum curculio (*Conotrachelus nenuphar*).
Fig. 19. Spotted psyllobora (ladybird), (*Psyllobora 20-maculata*, var. *taedata*).
Fig. 20. Brown-neck ladybird (*Scymnus marginicollis*).
Fig. 21. Gray soldier bug (*Euschistus tristigmus*).
Fig. 22. Syrphus fly (*Catabomba pyrastri*).
Fig. 23. Spine-legged soldier bug (*Sinea spinipes*).
Fig. 24. Ashy-gray ladybird (*Coccinella oculata*, var. *abdominalis*).
Fig. 25. Lace-winged fly (*Chrysopa Californica*); showing fly with wings expanded.
Fig. 26. Lace-winged fly (*Chrysopa Californica*); showing fly at rest, with folded wings.
Fig. 27. Lace-winged fly, larva.
Fig. 28. Brown hemerobius (*Hemerobius*); unnamed.
Fig. 29. Eggs, lace-winged fly (*Chrysopa Californica*); as they are laid on slender threads.
Fig. 30. Cocoon, lace-winged fly (*Chrysopa Californica*); before hatching.



BENEFICIAL AND INJURIOUS INSECTS.

TWICE-STABBED LADYBIRD.

Chilocorus bivulnerus, Mulsant.

[Figs. 6 and 7, Plate IV.]

This pretty little beetle, with bright red spots on its wing covers, resembles the eyed ladybird (*Coccinella oculata*, Say), and has often been described as such. It resembles Pilate's ladybird (*Exochomus Pilatei*, Mulsant), which is also a ladybird with two bright red spots on its wing covers; but this species is much smaller, and the spots are not red, but of a light yellow color. Pilate's ladybird is the largest of the three species so marked. The larva of this species is a very peculiar one, and differs from all the other species, excepting the larva of the *Exochomus Pilatei*. The body of the larva is covered with many long spines, which serve as a protection against other insects, as upon being touched the raising of the spines is noticed. The color is entirely black (see Fig. 7, Plate IV), with a yellow band across its back, indicating where the larval skin splits, after it has transformed into a pupa, and from which the beetles emerge.

The beetles are shining black in color. To the naked eye it would appear that the spots on its wing covers are perfectly round, which is not the case. They are very irregular.

PILATE'S LADYBIRD.

Exochomus Pilatei, Mulsant.

[Fig. 9, Plate IV.]

"The larva of this species quite closely resembles that of the twice-stabbed ladybird, but is of a lighter color, and attains a larger size, the full grown larva measuring about one quarter of an inch in length. The pupa is formed within the old larval skin, the latter simply splitting along the back, as in the preceding species. The exposed part of the pupa is of a pale yellowish color, and is marked with two rows of black spots. The beetle is larger than the twice-stabbed ladybird, and may easily be distinguished from it by having the posterior part of the under side of the body black, whereas in the preceding species this part of the body is reddish."—Coquillett.

This species feeds very largely upon the black scale (*Lecanium oleæ*), and is mostly found in the southern part of the State. At one time I confined several beetles in a box; four days later the box was opened, their food had become exhausted, and the larger beetles had eaten up the smaller. The larva of this species is larger and quite different from that of the other species. It is of a light blackish color, and has light reddish markings and a flat head, which is large and prominent. After the escape of the beetle the pupa case becomes of a white color and the spines black.

THE EYED LADYBIRD.

Coccinella oculata, Say.

[Fig. 8, Plate IV.]

"This species is not very common in this State, and I cannot find it mentioned in any of the lists as occurring east of the Rocky Mountains. It hardly seems possible that the form figured at 8 belongs to the same species as the one figured at 24, yet it is so regarded by our best authorities. Upon this subject, Dr. G. H. Horn, our best authority on this group of insects, writes me that, as strange as this may seem to you, it is a demonstrable fact. *Exochomus* and *Chilocorus* have species resembling the typical *Oculata*, but these have a very different thorax. I inclosed several ladybird larvæ in one of my breeding cages, supposing that they belonged to the same species, and from them I bred both the typical form of *Oculata* and also the variety *Abdominalis*, the larvæ and pupæ of these two forms being indistinguishable."—Coquillett.

This species resembles *Chilicorus bivulnerus* and *Exochomus Pilatei* very closely, the beetles of these three species having two red or yellow spots on the wing covers. There is, however, a very marked difference. The spots on the wing cases of this species are yellow, while those of *Bivulnerus* and *Pilatei* are bright red. These latter species have no markings about the head and thorax as in this species.

This species, however, is somewhat rare and is but seldom met with, although in some localities it has been found quite abundant, especially where the trees are badly infested with the black scale (*Lecanium oleæ*), upon which they feed.

ASHY-GRAY LADYBIRD.

Coccinella oculata, var. *abdominalis*, Say.

[Fig. 24, Plate IV.]

This very pretty beetle is found upon different kinds of trees throughout our State infested by various kinds of aphis and scale. It is not a very common species and is only found occasionally. It abounds mostly on citrus trees, especially where they are infested with the black scale (*Lecanium oleæ*). The larva, when about to transform into a pupa, attaches itself by the end of its abdomen, and the skin splits at the back of the head and shrinks back about the posterior end of the body. The beetle is of an ashy gray color, of semi-globular shape. It has seven very small black spots on the thorax, and eight prominent black spots on each wing cover. The illustration gives the beetle's natural size and color.

AUSTRALIAN LADYBIRD.

Vedalia cardinalis, Mulsant.

[Figs. 11, 12, and 13, Plate IV.]

Of the introduction and benefits derived from this ladybird the public is, no doubt, well aware; therefore, a repetition of the facts at this time seems totally unnecessary. (See Annual Report State Board of Horticulture, 1889, pp. 260–67.)

The beetle (Fig. 11, Plate IV) is a beautiful one, of black and vermilion red markings, as shown in the illustration. The larva (Fig. 12, Plate IV) is of a dark orange red color, and differs in form and general appearance from the larva of the other species. "When about to pupate the larva attaches itself by the posterior end of the body to the bark or leaf of the tree, and suspends itself head downward. It remains in this position about three days, when the skin along its back splits open, exposing a portion of the pupa to view. When the beetle is fully formed the old pupa skin partially breaks away, showing the beetle to be of a pale reddish color. It remains in this situation about two days longer, when the beetle issues clad in its normal colors of black and red;" * as shown in the illustrations, Figs. 11 and 13, Plate IV. This species does not feed, as far as known, upon any other insects than the cottony cushion scale (*Icerya purchasi*), although of late several statements have appeared in various newspapers to the contrary; but as this matter has been carefully experimented with, I doubt the correctness of the statements so made. (See Annual Report State Board of Horticulture, 1889, p. 269.) This species has practically exterminated the cottony cushion scale; at least, it is no longer a pest in California.

The winter of 1889-90 was a very severe one upon the increase of parasitic and beneficial insects, as it rained almost continuously until spring. This was the Vedalia's first winter in California, and grave doubts were entertained as to their living through it. In early spring (1890) it looked very much as if they had died out, as neither the larvæ nor the beetles could be found; but a few weeks of warm sunshine caused them to multiply, and our hopes were gratified by discovering thousands of the larvæ at the various stations of the Board, where they were placed with due precautions late in autumn, and before the wet weather had set in. From these stations all infested orchards throughout the State have been supplied with colonies of Vedalias, and they have increased so fast that no further distribution of colonies is at this time necessary.

TWO-SPOTTED LADYBIRD.

Adalia bipunctata, Linn.

[Figs. 2 and 3, Plate IV.]

In walking through the grounds of the Department of Agriculture at Washington (May, 1890), I observed this little beetle preying on the aphis upon some bushes, and on close examination noted the fact that they were destroying myriads of plant lice. I examined closer into their natural fecundity, and became so impressed with their work that three large colonies were captured and sent to this State for propagation, with the hope that they would increase and multiply rapidly enough so as to be able to distribute colonies to other sections.

The larva (Fig. 3, Plate IV) is a voracious one, very pretty, and quite large, as shown in the illustration. The beetle (Fig. 2, Plate IV) is of a dark red color, and has on each wing cover a round black spot. The increase of this species will be watched with much interest, and we shall hopefully look for its progress.

*D. W. Coquillett, in "Insect Life," 1889.

AMBIGUOUS LADYBIRD.

Hippodamia ambigua, Le Conte.

[Fig. 15, Plate IV.]

This species is very abundant, and is found in almost every section throughout the State. It resembles the blood-red ladybird (*Coccinella sanguinea*), but is much narrower in proportion to its length, and flatter. The larva is one of the largest of the ladybirds, and feeds upon various kinds of aphis. This species is found very abundantly in the corn fields during summer; it is also found very abundantly among squash and cucumber vines, and, in fact, among all such trees and plants that aphis attack. This ladybird has been often observed feeding on the woolly aphis; its larvæ feed largely upon this aphis.

CONVERGENT LADYBIRD.

Hippodamia convergens, Guerin.

[Fig. 5, Plate IV.]

This species, like the preceding one, is very common throughout the State, and is also found in the summer very plentifully among corn and vegetable growth. The larva feeds upon aphis, and upon other insects. The beetles also feed upon aphis, young scale, etc. The beetles vary in color; some are of a deep red, while others are of a dull brown; the markings, however, are the same. This species has also been observed feeding on ripe fruit, but only after other insects or birds had first eaten into it. This ladybird, like the preceding, has been found feeding largely upon the woolly aphis, and Mr. D. B. Wier's observations at Petaluma this season warrant him in saying that "they kept the tree pretty well freed from the woolly aphis."

BLOOD-RED LADYBIRD.

Coccinella sanguinea, Linn.

[Fig. 4, Plate IV.]

This species is not very common, and is only occasionally met with. The beetle is blood-red in color; this, however, varies to brick-red, and is, indeed, very pretty. It is quite small, as the illustration shows, and almost hemispherical in shape.

SPOTTED PSYLLOBORA.

Psyllobora 20-Maculata, var. *taedata*, Le Conte.

[Fig. 19, Plate IV.]

The larva of this species resembles that of the ashy-gray ladybird (*Coccinella oculata*), but is of a lighter color, being pale gray, marked with a few black and yellow spots. When full grown, it measures only one tenth of an inch in length. The pupa also resembles that of the

above species, and its colors are the same as in the larva. It measures one tenth of an inch in length.

"I have seen both the larvæ and the adult beetles engaged in feeding upon the common red spider (*Tetranychus telarius*)."—Coquillett.

This beetle is mostly found on orange trees, and on garden plants, or wherever black scale and red spider abound.

It is a very small beetle, and moves along very lively. Upon being disturbed, it draws its legs together and drops from its perch, seemingly to the ground, but, as it drops, expands its wings and flies away.

BROWN-NECK LADYBIRD.

Scymnus marginicollis, Mann.

[Fig. 20, Plate IV.]

This little ladybird may be seen on trees infested with scale, but mostly on trees infested with red spider. To the naked eye it appears deep black and shiny, and at the touch drops or rolls off, but before striking the ground spreads out its wings and flies away. The color of the body is yellowish gray, and is thickly covered with mealy powder. The head is black and the neck brown. The wing cases are black and covered with hair, as shown in the illustration (natural size). This ladybird is not very numerous in orchards, and does not seem to increase as rapidly as the other species, and therefore the benefit derived from it amounts to but little. This species is found generally throughout the State, but, being so small, is but seldom observed.

JULIAN'S LADYBIRD.

Coccinella trifasciata, var. *Juliana*, Mulsant.

[Fig. 14, Plate IV.]

This pretty, light colored beetle (Fig. 14, Plate IV) is one of the handsomest of the ladybirds, and was found by me feeding on the black scale (*Lecanium oleæ*), at Mission San José, Alameda County. The larva was not found, and cannot therefore be described. Public attention has never been called to its importance, and the beetle is now illustrated for the first time.

"On this continent it is found from the Atlantic to the Pacific Ocean, and it also occurs in Europe and in Asia. The earliest record I possess of its occurrence on this coast is by the Russian entomologist, Mannerheim, who records its capture in Alaska, in the year 1853. The species is very rare here, and I have never found its larva."—Coquillett.

The illustration is an exact likeness of the beetle, and its progress will be watched with much interest.

STRIPED LADYBIRD.

Magilla vittigera, Mannerheim.

• [Fig. 10, Plate 14.]

This species of ladybird has often been mistaken for the striped squash or cucumber beetle (*Diabrotica trivittata*). As it resembles that insect somewhat it has been supposed to be injurious. This species usually collects in great numbers, and are mostly to be found on swampy land.

"They are found as far east as Kansas, and extend southward into Mexico."—Coquillett.

As they abound mostly on swampy land, it is reasonable to suppose that they prey upon soft-bodied insects that live in such localities. The beetle, as shown in the illustration (Fig. 10, Plate IV), is but a trifle larger than the three-lined squash or cucumber beetle (*Diabrotica trivittata*), but the stripes are of a much darker color, varying from dark brown to almost red. The antennæ of the diabroticas are quite long and slender and many jointed; the antennæ of this species are quite short, as shown in the figure.

SPINE-LEGGED SOLDIER BUG.

Sinea spinipes, Herrick-Shaefer.

[Fig. 23, Plate IV.]

This soldier bug is found in most parts of the State, but is by no means common. It is mostly found on orange and lemon trees where scale insects are numerous, also on trees infested with aphis. Fig. 23, Plate IV, shows the adult insect, natural size and color.

"They kill their prey by inserting into it the proboscis, which injects a most powerfully poisonous liquid into the wound. The victim thus pierced dies in a very short time. They then leisurely suck the juice out and drop the empty skin."—Glover.

They feed largely upon caterpillars, and upon all other insects they can overcome, even upon their own kind.

The soldier bug can always be seen through the summer months; those who prune trees become well acquainted with their larvæ (also that of the lace-winged fly), as they inflict severe wounds on the hands and neck of the pruner by action of their beak or mandibles.

GRAY SOLDIER BUG.

Euschistus tristigmus, Say.

[Fig. 21, Plate IV.]

This bug has often been supposed to be injurious, which is not the case; instead of being injurious it is highly beneficial, as it is a carnivorous insect. They attack caterpillars, aphis, etc., and pierce their bodies with their beaks and suck them empty. The color of the bug is dark brown, as shown in the illustration (Fig. 21, Plate IV). During

summer these bugs are seen on trees and small-fruit bushes, and have been found feeding on ripe fruit, but always on such fruit as other insects or birds had first punctured, and for this reason have often been pronounced injurious.

SYRPHUS FLY.

Catabomba pyrastri, Linn.

[Fig. 22, Plate IV.]

The larva of this syrphus fly is of great benefit in destroying all kinds of aphis. It is quite blind, but the egg from which it hatches is generally deposited by the parent fly in the midst of a colony of plant aphis, where it gropes about and obtains an abundance of food without much trouble. The larva is fleshy, thick, and blunt behind, and pointed in front.

Their mouths are furnished with a triple-pointed dart, with which they seize and pierce their prey, and, elevating it, deliberately suck it dry.

The flies (Fig. 22, Plate IV) are black, with transparent wings, and prettily ornamented with yellow stripes across their bodies. They are generally found on trees infested with black scale (*Lecanium oleæ*) or on trees infested with aphis.

The larva, when ready to change into a pupa, fastens itself to a leaf or branch by means of a glutinous secretion from its own body, and the outer skin, contracting into a pear-shaped case, soon hardens by exposure to the air; the pupa is formed inside. After a few days the perfect fly emerges from a hole at the blunt end of the case, to lay eggs among colonies of aphis. The fly has two transparent wings; its body is generally more or less banded with brown, black, and yellow, and it has the appearance of a diminutive wasp.

These flies make their greatest appearance in the early spring, and are quite common in most parts of the State.

LACE-WINGED FLIES, OR APHIS LIONS.

Nearly all the species of the subfamily *Chrysopinæ* pertain to the genus *Chrysopa*. These insects are known in the adult state as lace-winged flies, and in the larva form as aphis lions. The antennæ of the adult are long and setaceous. The venation of the wings resemble somewhat that of the subfamily *Hermerobiinæ*, but the subcostal and median veins are separate, and the transverse veins of the costal space are not forked. The lace-winged flies are very common insects throughout the summer months upon the foliage of trees, especially on citrus trees. They are usually of a light green color, or yellowish. While alive their eyes are very bright, and on this account they have also received the popular name of "Golden-eyed flies." Some species, when handled, emit a very disagreeable odor.

LACE-WINGED FLY.

Chrysopa Californica (new sp.), Coquillett.

[Figs. 25, 26, and 27, Plate IV.]

*Description.**—Fly: Pale green, a yellowish white dorsal stripe extends from front of thorax to tip of abdomen; front of head whitish; an irregular wine-red stripe extends from each eye to the mouth, and on its hind border, next the eye, is a black streak; front corners of thorax marked with black. Antennæ pale yellowish, minutely ringed with white. Wings greenish hyaline, obtusely pointed at their tips; veins and veinlets wholly green; seven or eight of the veinlets along the hind edge of front wings, before the tips, are forked; stigma somewhat opaque, yellowish green. Legs green, tarsi whitish, the tips brown. Eyes greenish golden, becoming glaucous brown after death. In dried specimens the green coloring becomes more yellowish, and the tarsi assumes a slightly darker color than the tibiæ. Length 9 to 10 mm. (about three eighths of an inch); expands from 24 to 28 mm. (about one inch, or slightly over).

In the monograph of the genus *Chrysopa*, given by Dr. Fitch, in his first and second reports as State Entomologist of New York, pages 84 to 92, the present species would belong to his division "25 (24)", which contains the single species, *Chrysopa Robertsonii*, found in the Indian Territory; but our species is easily distinguished from this by the markings of the head and thorax. Specimens have been submitted to Dr. Hagen, our best authority on these forms, and he regarded them as belonging to a new species.

Egg (Fig. 29, Plate IV) very pale blue, elongate-ovate, pointed at the base, the apex flattened, and in its center is a white, botton-shaped object; surface minutely granulated; length, three and one half hundredths of an inch; mounted on a bristle-like pedicel from thirteen to eighteen hundredths of an inch long.

Larva (Fig. 27, Plate IV) mixed with yellowish white and pinkish brown, the latter color forming a dorsal line and a series of lateral spots; along each side of the body is a row of yellowish white tubercles; head yellowish white, marked with two diverging black stripes on the top, and with a dusky streak each side, having in its middle a black dot; length 7 mm. (a little over one fourth of an inch).

Cocoon (Fig. 30, Plate IV) oblong in outline, being decidedly longer than wide; pale brownish gray, but when fresh is strongly tinged with green; length, 3 mm. (nearly one eighth of an inch).

BROWN HERMEROBIUS.

Hermerobius (unnamed).

[Fig. 28, Plate IV.]

This pretty brown fly with transparent wings, resembling the lace-winged fly (*Chrysopa Californica*), abounds in most orchards throughout the State, but is by no means common. The larvæ bear a strong resem-

* Described and named by Prof. D. W. Coquillett, Special Agent U. S. Dept. of Agriculture, at our special request.

blance to the larvæ of the lace-winged fly, but are much smaller. They feed upon aphis and other small insects. The larvæ, as they move about, are usually covered with debris, composed of the empty skins of victims, which they throw on their backs after having extracted their fluids. The fly is a very delicate one, as its increase has never been noticed. They no doubt die during certain climatic changes, as many of the dead flies are often found in the crotches of trees. This is evidently one of the reasons of their being so rare in places where, at times, they had been known to exist in great numbers.

CHEMICAL FERTILIZATION.

FERTILIZING AND FERTILIZERS—HOW TO COMPOUND FORMULAS.

Fertilizers have a wonderful effect upon plant life. The different elements described below are the most essential to plant growth. The best methods of compounding them are also described, although most of our soils possess the desired elements for plant growth, lacking phosphate.

POTASH.

Potash is the element potassium combined with oxygen—"potassium oxide," it is called by the agricultural chemists. Potassium itself is but a curiosity of the laboratory, for it can be kept pure only by excluding all air, and is therefore only to be found in the bottle of the chemist. The name "potash" was given it because it was made in iron pots from ashes.

Potash is a most caustic, biting alkali, dissolving and decomposing all organic structures it comes in contact with. It is one of the most powerful bases; in other words, it is a vigorous, unprincipled chemical thief, seizing upon and absorbing into itself the acids it finds combined with various saline compounds. Pure water could not dissolve the potash as it exists in the particles of feldspar and mica that are found in the soil; but, taking carbonic acid from the air, it has the power of dissolving the silicate of potash, leaving the quartz and alumina to form the clays. Caustic lime also has this power. The silica, combined with the potash, and marrying the lime, sets the potash free. In the vegetable kingdom it is held by plants while in the process of growth, in a soluble state, combined with oxalic, tartaric, silicic, and sulphuric acids. When wood is burned, these acids are decomposed; and, the potash combining with carbonic acid, we have the common form of carbonate of potash. Potash is not only one of the three essentials for all plant growth, but it is also found in the fruits, vegetables, and grains.

HUMUS.

There is a value in barn manure, in addition to its fertilizing properties. Its bulk has a mechanical effect on the soil, improving heavy soils and lightening the texture of all soils—a fact of especial value to market gardeners in their early crops. By its partial decomposition, it adds to the mass of dark brown earth which we so especially notice in old gardens, and which goes under the name of humus. Humus is dead vegetable and animal matter in process of decay. In good soil, there is, in a latent condition, potash, phosphoric acid, and lime. Carbonic acid changes these into plant food. Now, humus, by its decay, develops carbonic acid, and so brings about the decomposition of this latent food. Wet weather favors this action. That carbonic acid has this power to set free plant food in the soil has been proved by the experiments of Professor Stockhardt. Crops take up only a small portion of the fer-

tilizers applied before the nutrient substances they contain become insoluble. The humus keeps them in a soluble condition, which is an argument for the use of barn manure, or the plowing under of weeds or green crops, in connection with the use of fertilizers. It acts as a sponge to absorb and hold moisture in low, black soils, which are made up of dead vegetable matter in a state of semi-decay, halfway towards coal—a carbonaceous mass of stems, roots, and leaves. Burned, it makes an ashes red, from the presence of iron, having but one sixth the potash to be found in hard-wood ashes. The trouble is, that when dry it takes up water very slowly, and it takes therefore a good deal of rain to moisten it; while, on the other hand, when wet it keeps wet and cold too long for the health of vegetation. Without draining, manure is a waste on such soils.

Humus * holds a great store of carbonic acid, which decomposes the minerals in the soil, setting free potash and phosphoric acid. It also holds latent nitrogen, sometimes as high as 3 per cent, which is six times as much as in average stable manure. This is made plant food by the application of lime or carbonate of potash.

Humus is not in itself plant food. It is not necessary for the yield of heavy crops.

PHOSPHORIC ACID.

This, the third substance in the three components of a complete fertilizer, is composed of the element phosphorus, combined with the gas oxygen. The four great resources for phosphoric acid are the mineral called *apatite*, which contains 92 per cent of phosphate of lime, and is believed by some chemists to be the original source in Nature from which phosphate of lime is derived; the phosphatic guanos, which are the product of sea fowls, from which the ammonia has been washed out by the rain; the bones of all animals, and the mineral phosphate rocks, which are the remains of ancient marine animals.

BARN MANURE.

Its Composition and Fertilizing Properties.

The latest analysis made of fresh barnyard manure proved to contain the following kind and quantity of elements:

Water	71.3
Nitrogen	0.5
Silica and insoluble matter	10.5
Alumina and oxide of iron	0.7
Lime	0.5
Potash	0.4
Soda	0.1
Phosphoric acid	0.5
Chlorine	0.1

In about 4,500 pounds of fresh stable manure we should have in it 3,208 pounds of water, 22½ pounds of nitrogen, 472½ pounds of silica, 31½ pounds of alumina of iron, 22½ pounds of lime, 13½ pounds of magnesia, 18 pounds of potash, 4½ pounds of soda, 4½ pounds of sulphuric acid, 22½ pounds of phosphoric acid, and 4½ pounds of chlorine. By the composition given it will be noticed that bulk is not what is necessary,

* Professor Gregory—"How to Compound Fertilizers."

but instead of bulk the proper elements as fertilizers in a concentrated form are more valuable as plant food than many manures and many so called "commercial fertilizers" a hundred times as bulky. Fertilizers in some form can be made to last like barnyard manure, and feed several successive crops with a single application. For instance, in ashes and bone we have all the elements for a complete manure, when all that is required is to apply an extra quantity of ashes and a portion of the bone in a coarse state. Ashes are always enduring in their effect, and the coarser bone will be years in decaying and setting free nitrogen and phosphoric acid. To continually apply but a single one of the three elements which enter into the complete manure, and especially if that one should be nitrogen, and for a series of years be in marked excess of the other two, would, in the end, sooner or later prove that the conclusions often advanced are correct, however faulty they might have been in their reasoning. The fact that the one of the three elements, nitrogen, potash, or phosphoric acid, of which the soil has the least, and which has been repeatedly proven, will always be the measure of the crop. A hundred pounds of potash applied would not give a larger yield than five pounds (and so of the other two elements), if there is not a proportionate increase of the other elements.

"The right way is to make the most and best manure that is practicable upon the orchard, and piece out with such commercial fertilizers as experiments and experience prove profitable. At the same time there are many cases, especially near cities, where everything depends upon getting the largest and best (and earliest) yield, where the most exclusive use of chemical fertilizers is advisable." *

Artificial fertilizers are, of course, much more cheaply transported, and, unlike barn manure, they do not carry with them seeds of weeds into the soil, and as they contain the fertilizing elements in so condensed a form, the whole handling of them becomes much cheaper, where they can be obtained from reliable sources.

"Fertilizers rich in ammonia, Peruvian guano, sulphate of ammonia, etc., should be applied a little at a time, and often."†

Clayey soils do not, as a rule, need so much potash or nitrogen as phosphoric acid. Nitrogen tends to promote leaf growth. Fertilizers applied to poor land produce more effect than when applied to rich land. If the bone in the soil does not all decompose the first year, the nitrogen contained in it goes over with it and is not lost. If but one of the elements is to be used, it should, by all means, be bone, and the finer the bone, and the finer and drier the fertilizer, the more valuable it is. When the animal matter in bone decays, the phosphoric acid in the bone is in a reverted condition.

BONES.

The bones of land animals are composed of the following elements:

Gelatine, fat, and water	48.0
Phosphate of lime, with a little magnesia	46.0
Carbonate of lime	4.0
Potash and soda	2.0
	100.0

* Says Professor Atwater. † Professor Atwater, "Fertilization."

NOTE.—The grower should not forget that in using potash or phosphoric acid in any form, it never wastes in the soil to any extent, and one application will last several years.

The gelatine contains from 3 to 5 per cent of nitrogen, and the phosphate of lime (or bone phosphate) from 18 to 23 per cent of phosphoric acid. Bones are brought to the fertilizer manufacturer as the waste of the slaughter-house or butcher shops. Where they have been exposed to the action of the elements bones are found to have lost more or less of their gelatine, and hence are not so rich in nitrogen. The methods of preparing bones for plant food are numerous. By one method the gelatine is saved, and by the other lost. To make the phosphoric in this fully soluble, the bones must be first treated with sulphuric acid, though the results from burning the bones are to reduce the particles to so fine a state as to make them more or less available without the use of acid.

BONE MEAL.

This substance is made by cracking up and grinding dry bones. These contain, as materials valuable for fertilizers, phosphate of lime and certain complex substances containing nitrogen. The phosphate is the chief constituent; it forms the frames of the bones, and is what might be called the mineral portion of the same. The other plant food contained in bones belongs to that class of matter from which the plant obtains the material necessary for building (the so called albuminoid substance), to which those substances owe their nourishing and flesh-forming qualities. The more finely divided a fertilizer is the more valuable it is, on account of the greater readiness with which it goes into solution. Hence, in determining the value of a fertilizer, the mechanical analysis is of considerable assistance.

MANUFACTURING SUPERPHOSPHATE.

In the manufacture of superphosphate, Professor Nichols recommends the following plan: Take a plank box four feet square and one foot deep. This may be simply water tight, and if so there must be no nails that the acid can reach, for it will eat them out and so make a leak, or it may be lined with lead, all soldering being done with lead solder. The box will be large enough to take a carboy of sulphuric acid with the necessary quantity of phosphate material and water to make about a quarter of a ton of superphosphate. If finely ground bone be used, the result following will be a pasty mass, needing mixing with muck or other dry material to get it in good mechanical condition for use. If, instead of bone, bone black is used, the result will be a dry mass easily handled. To make superphosphate, a carboy of one hundred and sixty pounds of sulphuric acid or oil of vitriol (60 degrees), three hundred and eight pounds of bone black, and ten gallons of water are required. Having first donned old clothes, and having at hand a little saleratus or some alkali, ready to rub on any spot should by chance a drop spatter (for where it touches if not immediately neutralized it will char like fire), *be sure to first* pour in the water, and then the acid; next, slowly add the bone, stirring it all the while with an old hoe of but little value. There will be a great commotion, a great boiling, frothing, and foaming, and throwing off of heat with a suffocating vapor. Because of the suffocating vapor, it is better to do the work in the open air or under an open shed.

Professor Johnson in his report (Connecticut Experiment Station,

1881) gives two methods; the one which he considers best adapted for domestic use of any of the processes involving the use of oil of vitriol, is as follows: Take one hundred pounds of ground bone, such as contains 20 to 50 per cent, more or less, of material coarser than would pass through a sieve, having a one half inch mesh, twenty-five pounds of oil of vitriol, and six quarts of water. Separate the bone by sifting into two, or if the proportion of coarse bone is large, into three parts, using sieves of one sixteenth and one eighth inch mesh. Mix the coarser part of the bone in a cast-iron or lead-lined vessel with the oil of vitriol. When the bone is thoroughly wet with the strong acid add the water, stirring and mixing well. The addition of the water to the acid develops a large amount of heat, which favors the action. Let stand, with occasional stirring, for twenty-four hours, or until the coarser fragments of bone are quite soft, then three grades of bone are used. Work in the next coarser bone and let stand another day or two, until the acid has softened all the coarse bone, or has spent its action; finally, dry off the mass by mixing well with the finest bone.

In carrying out this process, the quantity of oil of vitriol can be varied somewhat; increased a few pounds if the bone has a large proportion of coarse fragments, or diminished if it is fine.

Professor Stockhardt, the celebrated agricultural chemist, recommends the following process: From a mixture of sifted wood or coal ashes and earth thrown upon a barn or shed floor form a circular wall so as to inclose a pit capable of containing one hundred weight of ground bone; then make the surrounding wall of ashes so firm as not to yield by being trodden on; sift off the finer part of the bone and set it aside; throw the coarser part into the cavity and sprinkle it, during continued stirring, with three quarts of water, until the whole is uniformly moistened; add gradually eleven pounds of oil of vitriol of 60 degrees strength, the agitation of the shovel being continued. A brisk effervesence of the mass will ensue, which will not, however, rise above the margin of the pit if the acid is poured on in separate small quantities. After twenty-four hours sprinkle again with three quarts of water, add the same quantity of sulphuric acid as before, with the same brisk shoveling of the mass, and leave the substance to act for another twenty-four hours upon each other; then intermix the fine bone previously sifted off, and finally shovel the ashes and the earth of the pit into the decomposed bone until they are all uniformly mixed together.

It will be noticed that the last two processes use half or less than half the usual quantity of acid allowed for a hundred pounds of bone. The phosphoric acid in finely ground bone can also be made available by the caustic action of the potash in unleached wood ashes.

Professor Nichols recommends the following method: Take one barrel rawbone flour, three barrels dry unleached wood ashes, ninety pounds gypsum, and ten gallons of water; make a heap of the solid materials on the barn floor, and add the water, stirring constantly with a hoe. The result is perfect plant food, containing all the elements plants require in about the same proportions.

Professor Dooling advises a little different method and proportions. He recommends the following: Mix five barrels of finely ground bone with five barrels of unleached hard-wood ashes, and add water sufficient to moisten the mass, and then cover with loam. Leave the heap three

weeks, adding a little water, if it, on examination, appears to be nearly dry.

WOOD ASHES.

Wood ashes are our great home source for potash. These are brought into the market from several sources. "Wood ashes," says Professor Goessimann, "have an agricultural value much above their chemical value." Professor Gregory adds that "the principal reason of this is that they contain not only potash, but all the elements of plant food except nitrogen, and these in just the same proportion as they exist in Nature, with the additional advantage of having them in a very fine state of subdivision."

The wood of different trees differ not only in the proportion of potash, lime, and phosphoric acid in their ashes, but also in the quantity of their ashes in equal quantities by measure of wood.

COAL ASHES.

Coal ashes contain no appreciable amount of potash; the chief ingredient is silica. They contain also some lime and magnesia. The trace of potash comes from the wood used in kindling fires, and the coal itself. Coal ashes prove of but little value on most soils, beyond making heavy soils more open and supplying silica to land of a much like character; still there is considerable of value in them when used in connection with manure.

COMMERCIAL FERTILIZERS.

THEIR USE OF MODERN ORIGIN.*

The use of fertilizers as articles of commerce is of modern origin. The fact that soils deteriorate by continued cultivation and removal of crops had long been observed before the cause was understood and the remedy applied. In the early history of this and other countries, the virgin soil produced abundantly, and continued to do so without application of any kind, until the idea was prevalent that fertile soils were inexhaustible. The impoverishment, however, which eventually followed set men to thinking, and to devising means for the restoration of lost fertility. A close study of the soil, of the plant, and of the atmosphere, has revealed the relations they sustain to each other, and the conditions under which each can best contribute its part to the production of abundant crops.

THE COMPOSITION AND FORMATION OF SOIL.

An examination shows that soil is a mixture of more or less finely divided mineral and organic matter. This mineral matter consists of sand, clay, gravel, etc.; the organic matter of vegetable substances in various stages of decomposition. A closer examination, or analysis by the chemist, shows that these materials are composed of certain primary elements, united in fixed and definite proportions.

The geologist tells us of a time, in the far distant past, when the earth existed as a mass of melted matter, which, gradually cooling, formed a solid crust. Upon this was precipitated the condensed moisture of the atmosphere, loaded with all the waters of ocean, lake, and river, in the form of aqueous vapor. The disintegrating action of this powerful agency, added to that of the atmosphere itself, acting mechanically and chemically, crumbled and pulverized the surface of this solid mass until it became ready for the introduction and growth of plants. These, at first scanty, germinated, matured, and decayed, until vegetable mold had accumulated in sufficient quantity to sustain the growth of organic substances in rich profusion. The vast beds of coal, wherever found, result from masses of vegetable growth, accumulated long before man existed on the earth. The geological changes of the past, however great and long continued, were the same in kind as those now going on, and the same forces, acting on similar materials, are still producing corresponding results.

THE DETERIORATION OF SOILS.

The introduction of man into the world, with his varied material and artificial wants, modified to no little extent the conditions previously existing. At first, the earth spontaneously produced sufficient for his support, but as population increased, new wants were developed. In-

*N. T. Lupton, Bulletin No. 8, Agricultural Experiment Station, Alabama, 1889.

stead of consuming his food on the soil where it grew, and leaving there the residue to fertilize succeeding crops, he stripped the land of its growth, and accumulated its products in towns and cities, and that which he did not consume was cast into the sea or wasted in many ways.

The forces of Nature continued their renovating action by the production of new soil, and by clothing the hills and valleys with vegetation to supply the loss caused by man's extravagance, but eventually the richest lands of every civilized country were seen to be gradually but surely losing their power of production. This naturally led to an investigation of the conditions of plant growth, and the means best adapted to restore and maintain a high degree of fertility. The results attained are the triumph of modern science and the boast of modern civilization.

THE COMPOSITION OF PLANTS.

The analysis of plants shows them to be composed of certain elements, from ten to fifteen in number. Ten of these are considered essential to plant growth, as follows: *Carbon, Nitrogen, Sulphur, Potassium, Magnesium, Hydrogen, Oxygen, Phosphorus, Calcium, Iron.*

Sodium, manganese, silicon, chlorine, with traces of bromine, iodine, flourine, and a few others are generally found, but are not considered absolutely necessary to the growth of vegetation.

These same elements are found in the soil from which they are derived, and a few of them in the surrounding atmosphere. So abundant are most of them that only a few are likely to become exhausted where a proper system of cultivation is practiced. These few constitute the valuable elements of

COMMERCIAL FERTILIZERS.

This term, as used, "does not include common lime, land plaster, cotton seed, cotton-seed meal, ashes, or common salt not in combination."

In estimating commercial values, only three constituents, viz.: phosphoric acid in its forms of solubility, potash, and nitrogen, are taken into account; not that these are more important to plant growth than others, but because they exist in such minute quantities in soils that they become exhausted very soon, and plants cannot grow without them.

So important for the manufacture of commercial fertilizers are the raw materials containing these constituents, that the earth has been searched and the seas explored to find localities where they exist. Millions of tons are used annually to supply the demands of modern agriculture.

SOURCES OF PHOSPHORIC ACID.

The chief sources of phosphoric acid are the bones of animals, guano, coprolites, or phosphatic nodules, mineral phosphates, and basic slag, generally known as Thomas' slag, or scoria.

The frame work of vertebrate animals consists of bones composed of about one third organic, and two thirds mineral matter. The mineral matter is almost entirely phosphate of lime, known to the chemist as tri-calcium phosphate. The organic matter found in fresh or raw bones undergoes rapid disintegration on exposure to the atmosphere, leaving the bone or tri-calcium phosphate as a white mass, insoluble in water.

Now, the plant requires its food to be in a soluble condition before it can be appropriated, and science has met this demand by converting insoluble bone phosphate into a soluble form. Sulphuric acid acts upon the ground bones by seizing upon a portion of the lime in the bones, and unlocks the phosphoric acid, producing the effect desired.

The natural phosphates are not absolutely insoluble in water, and, indeed, far from being so when in a finely divided state, and in the presence of acids in the soil produced by the fermentation of organic matter. Hence, ground bones, floats, and other forms of finely divided natural phosphates, have considerable value as fertilizers. Commercial acid phosphates are the results of the action of sulphuric acid on natural phosphates, which renders them soluble in water and better adapted to the necessities of plant growth. Phosphoric acid in commercial fertilizers exists in three forms of combination with lime, generally known as soluble, reverted, and insoluble. These are called *water soluble*, *citrate soluble*, and *acid soluble*.

The chemist, in analyzing a phosphate, first dissolves out and determines the phosphoric acid soluble in water, then acts upon the residue with a solution of ammonium citrate for thirty minutes, at a temperature of 65 degrees Centigrade, to dissolve out the citrate soluble, then acts on the second residue with hydrochloric acid to find the amount called acid soluble. A fresh portion of the phosphate is now taken, and the total phosphoric acid determined. From this, the sum of the water soluble and acid soluble being taken, the remainder is citrate soluble.

The water soluble is easily converted into citrate soluble by means of lime, and, without the addition of anything, undergoes a gradual change, and hence is said to be *reverted*. These two forms, water and citrate soluble, are considered *available* phosphoric acid. Animal charcoal, made from bones by driving off volatile matter, is known as bone black, and is used in large quantities to decolorize and refine sugar and other organic products. This bone black, in the course of time, becomes too impure for further use, and is turned over to the fertilizer manufacturers to be converted into acid phosphate.

Guano, the deposits and remains of countless flocks of birds which have inhabited from time immemorial the islands near the coast in tropical countries, is a prolific source of phosphoric acid. On some of these islands, such as the Peruvian, Patagonian, Falkland, and Ichaboe, it seldom rains, and hence the phosphate from this source is rich in salts of ammonia. Its condition is such that plants readily appropriate its constituents as food.

Fossil bones, in connection with phosphatic nodules, in immense quantities, are found in South Carolina, and to some extent in other States and countries of the world. These are the remains of extinct animals which lived and died in the swamps, shallow seas, and lakes of an age long anterior to the present.

It is estimated that over four million tons of South Carolina phosphates have been used since their discovery, some twenty or twenty-five years ago. These phosphates contain from 40 to 60 per cent of phosphate of lime, and are now the most abundant source of phosphoric acid.

Mineral phosphates, such as apatite, phosphorite, etc., apart from those

in connection with fossil bones, have not been used to any great extent in this country.

Basic slag, or Thomas' scoria, has of late years been used successfully as a source of phosphoric acid. Germany is said to have used three hundred thousand tons of this material during the past year. Many iron ores contain too large a percentage of phosphorus to be used in the manufacture of steel. Neither the smelting process nor the ordinary process of converting pig-iron into steel, removes the phosphorus contained in the ore. A few years ago a process was discovered in England and patented by Thomas & Gilchrist, which not only gets rid of the phosphorus in the steel, but leaves it in a condition to be used as a fertilizer. This process consists in converting into a phosphate of lime, by driving a powerful blast of air through the molten iron contained in a crucible lined with magnesian lime. The resulting lime phosphate contains from 15 to 25 per cent of phosphoric acid in connection with a large per cent of iron, and when reduced to a fine powder forms a good substitute for floats and ground bones. The iron ores of Alabama, similar to those in Europe, will doubtless in a few years be made to yield a slag sufficiently rich in phosphoric acid to serve as a commercial fertilizer. Experiments with this fertilizer have demonstrated its nature.

SOURCES OF POTASH.

Potash, a combination of the metal potassium and oxygen, is derived chiefly from kainit, muriate, wood, and cotton-seed hull ashes.

Kainit is found in some salt mines, notably in the mines of Stassfurt, Germany. It contains from 10 to 15 per cent of potash in the form of sulphate, the remainder being salts of sodium and magnesium.

Muriate is also a product of salt mines, and contains from 40 to 50 per cent of potash in the form potassium chloride.

The ashes of all plants contain potash in considerable quantities, and furnish a limited supply for the manufacture of fertilizers.

SOURCES OF NITROGEN.

Nitrogen, the most expensive constituent of commercial fertilizers, exists abundantly in the atmosphere, but in a condition that renders it unavailable as plant food. It must, for this purpose, be in combination as nitrate, nitrite, ammonia, or organic nitrogen.

Sodium nitrate, or Chili saltpetre, is extensively used as a source of nitrogen.

Ammonium sulphate from gasworks is also used.

Refuse animal substances, such as *dried blood*, *tankage*, *fish scrap*, etc., are valuable sources of nitrogen, but in the South *cotton seed* and *cotton-seed meal* are the most abundant sources of this element.

VALUE OF COTTON SEED AS A FERTILIZER.

A good sample of cotton-seed meal contains about 7 per cent of nitrogen, and in addition to this about 3 per cent of phosphoric acid, and 1½ to 2 per cent of potash. The cotton seed itself contains about 2½ per cent of nitrogen, 1¼ per cent of phosphoric acid, and 1¼ per cent of potash. One ton yields at the oil mill, on an average, seven hundred and

fifty pounds of meal, one thousand pounds of hulls, two hundred and twenty-five pounds of oil, and twenty-five pounds of lint.

The hulls in one ton, when burned, yield about fifteen pounds of ash. The oil and lint have no appreciable value as fertilizers, and very little more can be said of the hulls, as they contain a very large per cent of woody fiber, and undergo decomposition slowly. Estimating the value of seed as a fertilizer, according to the valuation placed on its important constituents, it is worth $12 80 per ton, or 21⅓ cents per bushel. To the orchardist it has a greater value than this as a feed-stuff for cattle, and if the manure be carefully preserved, very little of its fertilizing value is lost in feeding. So the farmer, by careful management, can realize a double value from his cotton seed.

THE MANUFACTURE OF FERTILIZERS.

Any orchardist can buy the raw materials, mix them together, and thus manufacture his own fertilizers at much less cost than the same goods sell for in the market.

Composts are the cheapest of such mixtures, and, indeed, are the most satisfactory form in which fertilizing materials can be used, especially for permanent improvement of the soil. An excellent compost for general use may be made of cotton seed, barnyard manure, and acid phosphate, in the following proportions: seven hundred pounds of barnyard manure, seven hundred pounds of cotton seed, and six hundred pounds of acid phosphate.

Several methods are in vogue for mixing the materials. The most satisfactory one consists in mixing them on the smooth ground, one ton at a time. The barnyard manure and cotton seed are first mixed and thoroughly moistened with water, then rolled or mixed with the acid phosphate. The mixture is spread out from six to ten inches deep, another ton, thoroughly moistened and mixed, is placed on this, and so on until the heap is from four to six feet high. This is allowed to stand at least six weeks before using.

The old method is to spread the barnyard manure on the ground from three to four inches deep, then the cotton seed, then acid phosphate. Add layer after layer until the heap is from four to six feet high, watering the mass until it is quite moist, and let stand about six weeks before using. When chopping down for use, mix thoroughly.

A third method is to open a deep furrow, scatter in it the materials, either one at a time or previously mixed, and bed on them, thus dispensing with the compost heap.

To prepare a good commercial fertilizer for general application, a floor is needed upon which to mix the materials, and a hoe or wooden mixer for stirring them together. Acid phosphate, cotton-seed meal, and kainit, or muriate, are the materials required for a "complete" fertilizer, and may be mixed in the following proportions: one thousand pounds of acid phosphate, eight hundred pounds of cotton-seed meal, and two hundred pounds of kainit.

If the land needs more phosphoric acid and less potash, use one thousand two hundred pounds of acid phosphate and one hundred of kainit, or none at all, and if nitrogen is greatly needed in the soil, use one thousand pounds of cotton-seed meal.

In the above formula, the per cent of phosphoric acid, nitrogen, and potash in the mixture, will be about as follows:*

One thousand pounds of phosphate, containing 15 per cent water and citric soluble acid, yield 150 pounds phosphoric acid.

Eight hundred pounds of cotton-seed meal with 3 per cent phosphoric acid, yield 24 pounds phosphoric acid.

Eight hundred pounds of cotton-seed meal with 7 per cent nitrogen, yield 56 pounds nitrogen.

Eight hundred pounds of cotton-seed meal with 1.75 per cent potash, yield 14 pounds potash.

Two hundred pounds of kainit with 12½ per cent potash, yield 25 pounds potash.

Thus, we have in one ton, 164 pounds of available phosphoric acid, or 8.70 per cent.

Thus, we have in one ton, 56 pounds of nitrogen, or 2.80 per cent.

Thus, we have in one ton, 39 pounds of potash, or 1.95 per cent.

Commercial value, $25 92.

RATIONAL USE.†

While it is a fact that nitrogen, phosphoric acid, and potash are in most cases the only chemical constituents necessary to add to any soil to prevent ultimate exhaustion by continual cropping, the knowledge of that fact becomes profitable largely in proportion as it is modified by the individual farmer so as to conform to his soil and his crops.

It happens too frequently that the increase in crop from the use of complete manures is produced by one or two only of the elements present. When, as is often the case, nitrogen is either inactive or produces an abnormal effect from the presence of insufficient quantities of phosphoric acid and potash, and immediate returns are unsatisfactory, future gains are also problematic, since nitrogen in readily available forms is easily movable in the soil, and eventually lost. Phosphoric acid and potash, on the other hand, if inactive for immediate crops, are retained in the soil, and serve for future crops.

Statistics in regard to the composition and cost of complete manures in 1888, showed that the average cost of the nitrogen contained in them was just one third of their total cost. In the use of fertilizing materials, and especially of this most expensive element, *nitrogen*, great care should be exercised; and the use of unmixed materials, for studying the various soils and crops, is particularly advised.

APPLICATION OF FERTILIZERS.‡

With the exception of the second application of nitrate of soda, all fertilizers were applied and well raked into the soil previous to setting the plants. The mixed minerals and the manure were applied broadcast over the whole of each plot.

Each application of nitrate of soda was distributed evenly over about one half of the space occupied by the row.

NITRATE OF SODA, POTASH, PHOSPHORIC ACID.§

Used alone or in connection with Phosphoric Acid and Potash.

The experiments conducted with nitrate of soda, used either alone or in connection with phosphoric acid and potash, by Mr. Voorhees, proved

* N. P. Lupton, Chemist, Agricultural Experiment Station, Ala., Bulletin No. 8, 1889.
† Bulletin No. 53, New Jersey Experiment Station, 1889.
‡ Bulletin No. 63, New Jersey Agricultural Experiment Station.
§ Experiment on Tomatoes, New Jersey Agricultural Experiment Station.

conclusively the fact that nitrate of soda was effective in increasing the yield in every case. It was effective in *increasing maturity* from both the standpoints of *yield and money value* on six out of the eight plots upon which it was applied. The percentages of early yield and total money value did not show a marked variation, and averaged 20.3 per per cent and 46.1 per cent, respectively. These percentages were a gain over those on plots manured either in the fall or spring, and a loss over that secured from the use of phosphoric acid and potash. The total yield on one plot, however, was 33.5 per cent *less* than the average yield of four plots upon which nitrate was used alone, and 43.8 per cent *less* than the average yield from four plots upon which nitrate had been applied in connection with phosphoric acid and potash.

Both yield and maturity seem to have been retarded by nitrate of soda used in large quantities. In one application, the average value of early tomatoes on these plots was but 39 per cent of the total value; and the average total value of the product was 12.6 per cent less than the average value of the other nitrated plots.

With these two exceptions, there was a normal development of the tomato in all directions from the use of nitrate of soda, viz.: an increased yield, with a proportionate increase in early maturity.

These average results, while positive, show that the question of this section is modified by the elements of *quantity applied* and *method of application*, and point to these general conclusions:

1. That nitrate of soda *did not* increase the yield at the expense of maturity, when applied in *small* quantities, or in *large* quantities in *two applications*. This was equally true, both when used alone and when used in connection with phosphoric acid and potash.

2. That nitrate of soda *did* increase the yield at the expense of maturity, when *large quantities* were added in *one* application, both with and without the presence of a sufficient excess of phosphoric acid and potash.

AVERAGE YIELD OF CROPS.

Nitrate of Soda Used Alone.

160 pounds per acre	985 baskets.
320 pounds per acre	970 baskets.
Extra increase in yield from use of smaller quantities	15 baskets.
Two applications	995 baskets.
One application	960 baskets.
Extra increase in yield in two applications	35 baskets.

Nitrate of Soda, with Addition of Phosphoric Acid and Potash.

320 pounds per acre	1,104 baskets.
160 pounds per acre	1,034 baskets.
Extra increase in yield from use of larger quantities	70 baskets.
Two applications	1,130 baskets.
One application	1,002 baskets.
Extra increase in yield from two applications	128 baskets.

Yield with two applications of nitrate—
With phosphoric acid and potash .... 1,130 baskets.
Without phosphoric acid and potash .... 995 baskets.

Extra increase in yield from use of nitrate with phosphoric acid and potash .... 135 baskets.

While this experiment was not planned to study the comparative effect of different fertilizers, points of interest have been developed which, if stated, may have an influence in guiding future practice with this crop.*

GROUND BONES.

The demand nowadays for fertilizing materials which are quick in action, has had a tendency to decrease the use of bones in many lines of agricultural practice, and their especial value, when properly prepared, is often overlooked. While those orchardists are becoming fewer who regard a fertilizer as of doubtful value which does not, in connection with a profitable increase in yield, also add to the fertility, there are cases which make that fertilizer a valuable one, which fulfills the latter condition. Market garden produce and quick-growing field crops, as a rule, respond more profitably to quick-acting manures, and require the continued addition of smaller quantities of the more soluble and available elements of plant food. On the other hand, fruit trees, permanent pastures, mowing fields, etc., while also responding to these, are further benefited by the addition of considerable quantities of materials which have a permanent effect, and furnish a gradual and continued supply of plant food.

Bones, though insoluble in water, are readily decomposed by the action of the soil, and furnish amounts of nitrogen and phosphoric acid to the crop from year to year in proportion to the fineness to which they are ground. These above conditions exist everywhere, and determine a place and use for bones, for which mixtures of other materials cannot be well substituted. It must be remembered, however, that ground bone is not a complete fertilizer, and also that permanent fertility cannot be secured, without a corresponding decrease in immediate gains.†

MECHANICAL CONDITION.

To determine the value of bones, both the amount of nitrogen and phosphoric acid and the degree of fineness are taken into consideration; the finer pure bones are ground, the more valuable they are, provided the whole of the bone is used to secure the fineness.

A mechanical analysis of a sample of ground bone consists in dividing it, by a system of sieves, into four grades, each grade having a different value for the phosphoric acid and nitrogen, as follows:

	Nitrogen, Per Pound.	Phosphoric Acid, Per Pound.
Finer than one fiftieth inch in diameter	16½ cents	7 cents
Finer than one twenty-fifth inch in diameter	13 cents	6 cents
Finer than one twelfth inch in diameter	10½ cents	5 cents
Coarser than one twelfth inch in diameter	8½ cents	4 cents

* Edward B. Voorhees, New Jersey Agricultural Experiment Station, 1889, No. 60.
† Edward B. Voorhees, Bulletin No. 60, New Jersey Experiment Station, 1889.

It is assumed that the relative percentages of nitrogen and phosphoric acid are the same in all grades. The values are computed by multiplying the pounds of nitrogen and phosphoric acid, per ton, as determined by analysis, by the per cent of each grade; the sum of the separate values of each making the total value of the sample.

NITROGEN.

While other conditions than fineness do have an influence in determining the agricultural value of the nitrogen in ground bones, it is quite reasonable to suppose that, with the present method of preparation, viz.: extraction of fat, subjection to steaming at high pressure, etc., the nitrogen contained in the finest grade is quite as available as organic nitrogen from other sources. The average cost per pound of the nitrogen from complete fertilizers, which is derived chiefly from organic matter, is this year 23.5 cents per pound. Considering it all to have come from materials equally as good as the finest form of bone, nitrogen in complete fertilizers this year costs almost 50 per cent more than the average cost of nitrogen in the finest bone.

PHOSPHORIC ACID.

It is well known that the principal advantage of soluble phosphoric acid lies in the fact of its easy distribution, and its immediate availability on most soils. Phosphoric acid in ground bones of the finest quality is practically insoluble in water, but is quite readily dissolved by ammonium citrate, under the methods of treatment for determining reverted phosphoric acid. Hence, available phosphoric acid in complete fertilizers, which includes both the soluble and the reverted, costs this year, on the average, 9.9 cents per pound. The phosphoric acid in bones of the finest character costs 6.8 cents per pound, and of the samples examined over 45 per cent of the material was of this fine grade. This value of the fine grade is modified somewhat by the less availability of coarser and cheaper grades, which accompany the finer in nearly all samples, and must be determined by individual ability to profitably use the latter.

ON THE MOST PROFITABLE USE OF COMMERCIAL MANURES.*

The aim of this paper is to present, in the briefest possible outline, the present situation, in several chapters, of manuring, and then to attempt to give proper place and value to the experience of the past decade in the science of manuring. This latter will at the same time be presented in somewhat changed and enlarged proportions.

I at once present this question: Under what conditions is it possible to essentially increase the return from the soil by the application of artificial fertilizers? The answer is: Wherever hungry plants grow, wherever the earth produces plants which hunger for nitrogen, phosphoric acid, or potash, there the application of commercial manures should be made.

The cause for small returns is not always a lack of plant food. Often the plant suffers from thirst; from insufficient porosity of the soil, whereby the root development is checked; from caking of the soil, which works harmfully; from impenetrability of the soil, by which stagnant water with all its attendant evils is entailed; from deficiency of lime, of humus, etc.; in short, there are very many physical and chemical relations of soil or unfavorable conditions of weather which prevent the plant from a healthy development, and which diminish the crop.

In such cases, generally, the plant has no need of a large addition of food; it does not hunger. The small quantities of nutriment present in the soil suffice to produce the crops possible under so unfavorable circumstances. Here the establishment of better conditions must be made by irrigation or draining, deep culture, better plowing, harrowing, hoeing, marling, mucking, etc. The plants will then attain a development requiring, for the production of the harvest then possible, a greater food supply than the unenriched soil can yield.

Deep, well tilled, humus loam, under good atmospheric conditions, offers, therefore, relatively the best pledge for a sure effect from commercial manures; and every means which improves the quality of soil advances the success of the same. Luxuriant plant growth and intensive soil culture are synonymous with intensive conversion of plant food into crops. The demand for, and consumption of, plant food must therefore always be greatest where the greatest yield is produced or producible. In a given case, the more favorable the conditions, aside from those relative to nitrogen, phosphoric acid, and potash, the faster will be the consumption of, and the quicker the hunger for, those substances, and just so much earlier can an addition of plant food, beyond that barely necessary to appease hunger, be made to the crops; that is, the crops can, as it were, be fattened.

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*By Prof. Paul Wagner, Director of the Agricultural Experiment Station, of Darmstadt, Germany, translated by Prof. Charles Wellington, and published in a special bulletin by the Massachusetts Agricultural College, May, 1890, and now republished in answer to the demand for information on the subject.

In intensive cattle feeding, something more is sought to be accomplished than the satisfying of the mere needs of the animals. Were it simply a question of appeasing hunger, food could often be saved. But a further end is sought, namely: an intensive conversion of fodder constituents into animal matter within the animal organism, namely: a production of milk, muscle, fat, which shall be considerably greater than that actually demanded by the animals, and which can only be accomplished by increasing the appetite by the use of specially palatable and easily digestible food.

But the same order holds in crop production. When feasible, plants should be cultivated which possess prominent productive powers, as it were, great fattening capacity; and these plants should be stimulated to more intensive assimilation and work of transmutation than correspond to their normal necessities, by being supplied with easily soluble manures. As already stated, the best possible results are to be reached only on better grades of soil, and under relatively favorable conditions. Still, it would be a grave mistake to assume that artificial manures can be used advantageously only on the better grades of soil. This would be absolutely incorrect; for large, and, under favorable circumstances, larger results are secured from the application of artificial manures on poor and even neglected and exhausted soils. In such cases, the application of fertilizing materials must be made with greater precaution and intelligence; for it demands far greater attention to special conditions, and entails greater risk than with better soils. Saltpetre manuring, for example, on soils of low grade requires more precaution than on medium soils. After the application of saltpetre, the danger of loss of nitrogen has to be taken into account, in extremely permeable soils subject to repeated rain washings, and in heavy soils that are liable to cake and harden. Moreover, a very light soil often permits the plants to thirst in midsummer, and thus renders them incapable of elaboration of large quantities of nitrogen. For this reason, on such soils artificial manures are more frequently applied with winter crops, while in spring crops the chief feeding period is advanced as much as possible.

Unfavorable physical conditions of soil diminish the guarantee of a satisfactory effect from commercial manures; and yet, in the use of these, it is possible to check the interference of the former with plant development. Intensive nutrition of the plant in its earlier stages effects a deeper root growth, whereby evil results of drought are prevented; it likewise effects an early shading of the ground, which opposes surface hardening, also a more vigorous development of the plant, thereby diminishing danger from surface and subterranean enemies, which in unfavorable weather threaten in the form of fungous diseases, etc., and which, as is well known, are much greater in soils of poor quality than in those of better.

Although it is true that a soil well found as to culture and plant food better insures effect from artificial manures than a neglected and exhausted one, it is, on the other hand, important to emphasize the fact that a cautious and rational application of commercial manures to an exhausted soil can often bring about very valuable returns. As is generally known, an application of barnyard manure on such soils has very little effect at first; only after a series of years, and after repeated and heavy applications of manure, can the former fruitfulness of the soil be recovered. But, with the aid of artificial manures, we are in a position

to bring this soil to high productive power at once, and to retain it there until the barnyard manure yields generous results and has brought back a richness lost by previous irrational, exhaustive management.

By these brief hints it will be seen that artificial manures are applicable, not only to rich, but also to poor soils; and they can render the observant farmer, be his soil what it may, a most welcome service.

I will summarize as follows:

1. Commercial manures place the farmer who cultivates intensively in a position to bring his crops, even of those varieties which need most plant food, or are most productive, to their highest development, increasing the yield to a degree that is not possible by mere barnyard manuring; and, furthermore, they place him in a position to return very exhaustive crops to their former fields after relatively short intervals, and that without perceptible diminution of yield or exhaustion of the soil.

2. Commercial manures place the cautious and circumspect farmer in a position to increase, temporarily or permanently, the development of crops on every soil, even on the poorer, and to so adjust the nutrition of the same to the peculiar relations of soil, climate, and weather, as to secure full advantage from the favorable conditions, diminishing and, as far as possible, removing the unfavorable.

3. Commercial fertilizers enable the farmer who cultivates extensively to make the most of his wide acres for the storing of atmospheric nitrogen. Phosphates and potash salts give to lupine, clover, vetches, pease, serradella, etc., the power to withdraw from the atmosphere great quantities of nitrogen, thus enriching husbandry with the most valuable of all fertilizers. They also enable them to increase the food capital, and to gradually transform the extensive production into an intensive one, thereby increasing both the value of the land and the revenue.

The inquiry now is pertinent, What are the plant foods, and in what quantities shall we apply them in a given case in order to obtain the highest possible net profit? The answering of this query is fraught with difficulties. It is easy in a particular case to say whether or not commercial fertilizers would produce an increased yield. The crops often tell whether or not they are suffering from hunger. Their pale color betrays a lack of nitrogen, or a red-brown shade in the green of the leaves indicates that the slowness of their development, in spite of rain and sunshine, is a result of insufficient nourishment. A single trial even shows whether the soil is really receptive of manures, and, to the farmer's experienced eye, there is no particular difficulty in determining approximately the extent of this.

But the questions, which foods are superfluous, which, on the contrary, are necessary, and how much of each is demanded in a given case to reach the highest possible net gain, are not so easy to answer. I will attempt in a single example to state the case clearly, and to show the difficulty in question. Assume that we are able to raise the yield of a certain wheat field to the extent of two thousand pounds of grain. With what have we to fertilize the field? In two thousand pounds of wheat—grain and straw—there are, in round numbers, twenty pounds of phosphoric acid, thirty pounds of potash, and sixty pounds of nitrogen. Shall we produce the increased yield if we add these quantities of the respective substances to the soil? No; for with greater production of surface substance more roots are formed, and these also need food.

Furthermore, the fact must be borne in mind that the soil will not yield up to the plants immediately the entire amount of food which it has received. It retains sometimes more sometimes less for succeeding crops; consequently we must bring into the soil considerably more than the above.

Let us now assume that the following amounts have been added to the soil: one hundred and twenty pounds of phosphoric acid, eighty pounds of potash, and one hundred pounds of nitrogen. Can we now reckon on an increased yield of two thousand pounds of grain and about three thousand pounds of straw? Yes. But is this manuring a rational one? No; at least not unconditionally. And why not? Because we have wasted perhaps the one or the other of these food materials. Our task is to increase the yield by two thousand pounds at the least possible expense, for the gross yield is to us nothing, the net profit everything. In view of this, we must ask, is the soil really lacking in each of these food constituents, and to the amount assumed? Is it not possible that sixty pounds of phosphoric acid, instead of one hundred and twenty, would have sufficed, since perhaps the soil still contains residues of this material from previous manuring? Is it not possible that we could have omitted the potash application altogether, because the soil being naturally so rich in potash, has perhaps actually no need of application of potash salts? Or, again, if indeed one hundred and twenty pounds of phosphoric acid and eighty pounds of potash were really necessary to produce the increase, is it not possible that we could have economized in the costly nitrogen manuring? Is it not possible that the soil is chiefly exhausted only of phosphoric acid and potash, and that, in consequence of intensive barnyard or green manuring, or of the value of the humus or of rich nitrogenous remains, such as pea, vetch, clover, or lupine roots, etc., it contains an excess of nitrogen?

All this is quite possible. We have practiced great extravagance, and could have compounded a much cheaper manure and still have obtained the full increase. To manure rationally, we must question not only the needs of the plant, but also the manurial conditions and food supply of the soil. We must know both the quantities of food constituents which the crop needs, and also the amount of the various kinds of available food in the soil, to be able to judge whether the additional need of the crop in one or the other constituent cannot be supplied either entirely or partly from residues now in the soil.

By what means can we learn whether the soil contains a surplus of phosphoric acid or nitrogen or potash, or of any two of these? Can we learn by means of a chemical investigation of the soil? No; this has been tried repeatedly, but with no satisfactory result. The quantities of food constituents which are dissolved by chemical reagents do not always correspond to those quantities which the plant roots are able to appropriate from the soil. Therefore, conclusions respecting the fruitfulness of the soil, arrived at from study of the results of chemical analysis, are often entirely incorrect. Very often it has appeared that soils, which, according to the results of chemical analysis, are rich in phosphoric acid, are, so far as the plants are concerned, very poor in this constituent. Soils whose total content of phosphoric acid is relatively slight, are not always, by any means, in need of phosphate manuring.

Elements of plant food appear in great variety of combinations, and in many different degrees of solubility. Chemical analysis is not in a

position to apply a solvent to soils, corresponding to the decomposing agencies of the natural field and to the dissolving power of the roots. Such a solvent is not yet discovered. Safe conclusions concerning the needs of a soil, as to manuring, can be drawn from the results of chemical analysis only when these show exceptionally high or low amounts present. As a rule, therefore, we must seek other means for solution of the question before us. Such we have in the fertilizer experiment; and this brings us to a theme which might easily lead to tedious and prolonged discussions, but I shall endeavor to be brief. I will show in a few words that the fertilizer experiment, at least as it is commonly carried out, fails to accomplish the purpose.

Take, again, the above example, and let us assume that by the fertilizer experiment it can be proved whether potash or phosphoric acid or nitrogen, or any two of these materials, can be spared either half or entirely from the manure, without thereby diminishing the yield which would have been obtained by applying the entire manure. We make the following trials:

Number of Experiment.	Manurial Ingredients Applied in Pounds Per Acre.		
	Phosphoric Acid.	Potash.	Nitrogen.
1	—	—	—
2	54	36	44
3	—	36	44
4	—	—	44
5	54	36	—
6	54	—	—
7	54	—	44
8	27	36	44
9	27	18	44
10	27	—	44
11	54	36	22

Here are trials each of which should be made at least twice, which results in twenty-two trials. The amount of labor involved is great. Even if we brave the work and expense, will the result correspond to the trouble? Let us consider. Assume that the experiments have been carefully carried out, and are successful; that the weather has caused no failures; that there were no inequalities in character of soil; that birds have consumed the same amount from each plot; that the damage from insects, mice, and fungoid diseases, loss of seed in cutting, transporting, thrashing, etc., has fallen alike on all plots, so that the figures obtained can be accepted as sufficiently accurate. How far, now, do the results bring us? To what extent do they enable us to arrange a manure for our soils? Let us assume to have found, with or without phosphoric acid, an equal increase. We most certainly infer that, in the present case, it would have been rational not to fertilize this wheat field with phosphoric acid. But what further conclusion therefrom? That, in future, we do not need to manure this or similar fields with phosphoric acid? No; at least not without further study; for the phosphoric acid surplus shown by these experiments consisted, perhaps, simply of a quickly consumed residual from the last manuring, but not of an annually formed quantity of soluble phosphoric acid, coming from a reserve in the soil.

Thus, our twenty-two carefully executed experiments would have told us, at autumn, how we should have manured that particular soil in the spring. We do not know whether we should manure with phosphoric acid, and with how much we should manure the crops succeeding wheat, which would very possibly demand from the soil quite different proportions of phosphoric acid, etc.

This is indeed poor success. We may well counsel against such slightly profitable experiments, or indeed save ourselves even this effort; for the farmer, in spite of much advice to the contrary, never makes such experiments, and for this he cannot be blamed. I indorse his views, when he considers that a thorough and reliable experiment costs more than the value of the results, and that a superficial experiment and careless interpretation of results leads to very serious errors.

I am of the firm belief, that, in this entire subject, study has not been carried on in quite the right direction, and that fundamental reform must be aimed at, in order to render possible a well planned and rational application of artificial manures. At present, there is much to be desired. General rules are adhered to. Guessing and trying in every direction is the practice. Concerning the actual need of potash in the soil, we are ignorant; and we quiet our curiosity by applying here and there a little potash, without once knowing whether its application is in the right place, is sufficient, or, indeed, even necessary. We manure with superphosphate and Thomas slag according to the most general rules, but cannot possibly determine whether too much or too little is applied. We do not know how long a phosphoric acid application lasts, nor how much remains for the second and third crop after manuring. We do not know whether different phosphates become gradually more or less soluble in different soils, nor in what degrees. In short, we grope in the dark. The farmer can give himself no satisfactory account of his actions in these matters. It is therefore impossible for him to protect himself from profitless investment, or to get full advantage from opportunities offered. I will indicate the direction from which I hope for a change for the better, and present the following statements:

The belief in the necessity of accurately measuring the quantities of phosphoric acid and potash required by each cultivated plant is incorrect and irrational. The intelligent farmer, practicing intensive cultivation, long ago discovered the correct method of procedure. He places in the soil a surplus of phosphoric acid and potash; and this I hold to be entirely right. Nitrogen should be measured out to the plant as accurately as possible, but not phosphoric acid and potash. How much phosphoric acid is needed in a particular case, *i. e.*, for a particular plant on a particular soil, in order to produce the greatest possible yield, cannot be closely calculated. The one soil is rich in potash, the other poor; the one rich in phosphoric acid, the other poor. The one crop needs much easily soluble potash and phosphoric acid, the other little. The one soil yields the phosphoric acid, applied in easily soluble form, directly; the other renders it less soluble, and demands a relatively heavier manuring to produce an equal result. The one soil has never, or very rarely, received phosphates, the other large quantities almost yearly; and it is possible that the latter possesses a store equal to the demand for several years.

How can the farmer find his way through all these difficulties? He cannot. Nothing remains but to apply an excess of both food constitu-

ents; and in this there is indeed no danger, for potash and phosphoric acid are substances which the soil binds up and preserves for later crops, in case the one immediately following demands them only partially or not at all.

With nitrogen it is quite different. Nitrogen is not bound by the soil; it remains freely movable. The residual from a crop would be in danger, during the winter months, of being washed into the subsoil, and lost.

But, aside from all the difficulties, at present insurmountable, which prevent an exact measurement of phosphoric acid and potash, this is not the correct procedure; and, further, it is under all circumstances rational to apply a surplus of these food constituents. In support of this I adduce the following:

Assume that of the phosphoric acid in the soil not more than one half pound per acre can be assimilated. This, then, might suffice if the plant development progressed uniformly and the weather was favorable during the entire period of vegetation. But continuously favorable weather we never have.

Now, let the plants thirst for weeks at a time. No phosphoric acid is assimilated, nothing is elaborated. If rain comes and then warm weather, the plant must, if a maximum harvest is to be had, retrieve what has been lost, and within the next week elaborate as much as they should have done in two or three weeks' time. For this two or three fold daily production they require a two or three fold quantity of phosphoric acid; and this they can get only when there is in store a corresponding surplus, a supply from which, during a few days, the plant can draw more than under normal circumstances is necessary.

A sure maximum harvest, under actual circumstances, is only obtained when the plant is in position to take full advantage of particularly favorable weather, such as is presented only during very limited periods of time. The storage of phosphoric acid in the soil must, therefore, be sufficiently large to meet not only the normal demand of the plant, but also an occaional abnormal requirement. Consider the enormous amount of plant material often produced on a rich field, in a few days of warm, moist weather, and the large quantities of phosphoric acid which, within a short space, must be assimilated and incorporated.

What we have found to be true of phosphoric acid must also be true of potash; for this does not remain in freely removable condition, like the saltpetre nitrogen. It is absorbed, and only given up by the soil in small quantities. Therefore, I say a sufficient excess of phosphoric acid and potash must be present in the soil, a supply sufficient to satisfy the demand not only on days of normal production, but also on days of the most vigorous growth.

But if now we accept the demand for storing a surplus of phosphoric acid and potash in the soil as one of general importance, then the question relative to our fertilizer experiment takes a much more simple form, and its requirements are more easily fulfilled.

If a field be manured simply with the usual amount of phosphoric acid, leaving a small area—say fifty square yards—without application, it can be determined without difficulty whether the phosphoric acid acts or not. Any effect should be detected by the eye and, roughly, the amount. This is especially plain in the straw crops at a very early period, before and during the stem formation, and not, as has erroneously

been supposed, at the seed setting. If the phosphoric acid acts, then surely the manuring was necessary, and a sufficient surplus was not previously on hand.

With the next crop the manuring is to be repeated; and again a small piece—of course, in a different position from the first—is to be left free from manure. Observation is again made as to any effect and its degree. In case of an apparent effect, especially of a very marked one, the phosphate manuring is continued perhaps through a series of years, and eventually increased. From year to year, then, the soil becomes richer in this food constituent; for, of every two hundred pounds of soluble phosphoric acid brought into the soil, the next succeeding crop uses, as a rule, not more than twenty, forty, or sixty pounds, one hundred and forty to one hundred and eighty pounds remaining in the soil for the use of the succeeding cultures. Thus, from year to year, the point is neared from which the phosphoric acid manuring can be diminished without danger of starving the plants. In the execution of the experiments just indicated, which I will more minutely describe in another place, there is no difficulty in following the changes in the fertilized condition of the soil, or in drawing practical results from observations made.

The question, With how much phosphoric acid and potash shall we fertilize our domestic plants, in order to reach an increased yield of greatest net profit? would accordingly be answered as follows: By means of an easily performed experiment, whose results can be determined even by ocular observation, we determine whether, in the soil to be fertilized, there is a deficiency or surplus of phosphoric acid and potash. If a deficiency is shown, we apply the food constituents named, in quantities within the limits of ordinary practice. During the first years, in case the soil has shown itself to be very much in need of manure, heavy applications (sixty to seventy pounds of soluble, or one hundred and twenty-five to one hundred and forty-five pounds Thomas, phosphoric acid per acre) are made, in order to insure a sufficient surplus. With the phosphate manuring in particular, one should not be too economical. Phosphoric acid is now at a very low price, and the Thomas slag offers a most advantageous means by which to supply the soil with this ingredient. In vineyards, orchards, and every field on which deep culture is practiced, the lower soil layers should be furnished richly with Thomas slag. After having applied phosphoric acid abundantly during a series of years, light manuring may take the place of the heavy (twenty-five to thirty-five pounds soluble, or fifty to seventy pounds Thomas, phosphoric acid per acre). The after effect of early manuring is now obtained, and by experiment we determine whether phosphoric acid application cannot often be entirely omitted. When, for example, Mr. F. Heine, of Emersleben,* reckons that during a period of sixteen years he has incorporated into his farm an average per acre of not less than fifty-seven pounds of phosphoric acid a year more than he has removed, it is not surprising that further phosphoric acid manuring should effect nothing in his soil already so strongly enriched, and that he could rely for several years on this collected supply.

The necessary surplus of phosphoric acid must not be permitted to become a superfluity. This is also to be said concerning potash; but naturally rich potash soils are far more abundant than those rich in

* Deutche Landwirtschaftliche Presse, 1886, No. 33.

phosphoric acid, and with the potash supply of the soil more caution is necessary. Potash is indeed absorbed by the pulverized soil, but it becomes soluble again more easily than phosphoric acid; and many domestic plants are very sensitive to strong potash manuring. More attention is therefore to be given to potash manuring than to that of phosphoric acid, and care must be taken to avoid a too great surplus of potash salts in the soil.

The rule which the farmer must follow in supplying his crops with these important foods is clear in principle and very simple, namely: "to enrich the soil with the food constituents under consideration, until they are present in sufficient surplus—that is, till a further enrichment is without effect, and to hold the soil in this degree of food surplus."

Having reached this fundamental law for phosphoric acid and potash manuring, we turn to the subject of nitrogen manuring, and first ask, Must we manure all domestic plants with nitrogen? To this question we say, No. Pease, vetches, clover, lupines, lucerne, and similar plants make far less demands on the nitrogen content of the soil than oats, barley, wheat, rye, buckwheat, beets, carrots, potatoes, tobacco, flax, rape, grass, spurrey, white mustard, etc.; so that in exceptional cases can it be rational to manure the first named plants with nitrogen salts. They possess a peculiar power to avail themselves of atmospheric nitrogen, while the latter lack this ability, and must therefore draw the entire amount of nitrogen necessary for their development from the soil.

I have carried out, in connection with this question, very many experiments in the most diverse directions, and will here adduce a few examples from my results.

Manurings of eighteen, thirty-one, and forty-five pounds of nitrogen per acre were given various crops. Barley, rye, oats, wheat, buckwheat, carrots, potatoes, beets, flax, rape, grass, and spurrey furnished considerably increased yields, and the latter stood in exact relation to the increased manuring; while with pease, red clover, lupines, vetches, and lucerne no increase of yield was obtained. Let the following figures serve as illustration. For more convenient reading, I have placed the yield obtained with barley, without nitrogen manuring, at one hundred, and have reckoned the other yields to correspond:

Nitrogen Applied in Pounds per Acre.	None.	18.		31.		45.	
		Yield Obtained	Yield Calculated	Yield Obtained	Yield Calculated	Yield Obtained	Yield Calculated
Barley	100	161	167	220	218	272	268
Spurrey	114	176	172	214	215	254	258
Wheat	138	212	211	270	266	316	321
Flax	145	205	203	245	247	291	291
Pease	935	938	....	961	....	883	......
Lucerne	976	983	....	1,000	....	994	......

Here can be seen with what regularity and exactness the yields of barley, spurrey, wheat, and flax increased in relation to the increased manurings; while with pease and lucerne absolutely no increase of yield was obtained by nitrogen manuring. From the figures it is seen at once

that the pease and lucerne must have had access to a much richer source of nitrogen than the other plants. While the yield of barley, spurrey, wheat, and flax only reached one hundred to one hundred and forty-five on unfertilized soil, and could be brought up to about three hundred only after corresponding manuring; pease and lucerne gave on the same soil, unfertilized, a yield of nine hundred and fifty; and these plants obtained their nitrogen from so abundant a source that saltpetre manuring made no impression whatever on them. Similar results are reported by Hellriegel and E. v. Wolff. Still more striking are the data which I obtained from sterile sand taken from below the subsoil. The sand was placed in vegetation pots, furnished with all material necessary for plant nourishment excepting nitrogen, and planted with barley, rape, vetches, lucerne, and pease. Barley and rape developed on this almost nitrogen-free soil so scantly, that they furnished only from twenty-three to thirty-nine grains of vegetable matter; while, under the same circumstances, vetches, lucerne, and pease vegetated luxuriantly, and the latter yielded not less than one thousand three hundred and eighty-nine grains of vegetable substance. If we represent by one hundred the nitrogen contained in the barley and rape substance yielded, then the nitrogen of the pea substance harvested under like circumstances is presented by the enormous amount, eight thousand seven hundred.

Five years ago I proved and stated that lucerne, pease, lupine, clover, and similar plants possess powers of nitrogen assimilation specifically different from that of the straw crops, potatoes, beets, flax, rape, etc. The first named plants, as I said, draw from nitrogen sources which, for the straw crops, potatoes, and similar plants, are inaccessible, and in such large measure that, under normal circumstances of culture, a manuring with nitrogen salts is unnecessary.

We can therefore divide the agricultural plants into two groups, namely: nitrogen collectors and nitrogen eaters, as Schultz, of Lupitz, first proposed to name them; or, as I would suggest, into nitrogen increasers and nitrogen consumers. The nitrogen increasers (pease, vetches, lupines, clovers, etc.) are plants which increase the nitrogen content of the soil, and therefore the circulating nitrogen capital of the establishment, since they supply their chief need of this element from the atmosphere, and demand nitrogen food through the soil only during the first of their growth. The nitrogen consumers (straw crops, hoed crops, etc.) are, on the contrary, plants which consume the nitrogen capital of the establishment and of the soil; for they can appropriate what amounts to nothing from the atmospheric supply, and must absorb all nitrogen contained in their harvest products in the form of nitrogen salts. The great significance which the nitrogen increasers have upon the economy of the soil, and the magnificent service which they are able to render the farmer, I shall consider further on. We have to discuss at present the nitrogen manuring of these plants. In referring to what has already been said, I must again call special attention to the fact that the nitrogen increasers "attain the ability to supply their demand of nitrogen from the air only upon reaching a certain degree of development, and that it is very difficult for them before this period to dispense with the nitrogen of the soil." If, now, the soil contains nitrogen enough to feed these plants till they have attained this ability, an application of nitrogen is superfluous and absolutely irrational; but, if not

enough is present to quickly accomplish such a development, then a small manuring with Chili saltpetre or ammonia salts on the pease, vetches, clover, etc., is necessary, and can be made highly remunerative. In every single case the practical farmer must determine, if necessary, by experiment, whether the soil is so poor, so extremely exhausted, that even the nitrogen increasers must be given a nitrogen manuring. I believe that the application of nitrogen salts for these plants can be rational only in rare cases; and it is not difficult to determine such, for mere observation shows whether the plants require nitrogen or not. If one attempts, for instance, to grow vetches or pease on a completely sterile sand, devoid of nitrogen, the need of this element appears gradually but plainly in the diminutive form of the plant, and in the pale, sickly color of the leaves. These signs vanish quickly if the plants are fed with saltpetre. The pale color becomes green, new and healthy shoots appear, and a vigorous growth sets in. If, on the contrary, the plants are not manured, are allowed to hunger, the process of vegetation remains for several weeks in this inert condition; the evidences of starvation increase, till finally the atmospheric supply of nitrogen becomes accessible,, and the plants vegetate as luxuriantly as if they had been manured with saltpetre. Although it is indeed possible for pease, vetches, clover, etc., to attain the capacity, after continued starvation, to draw nitrogen from the air entirely, without the coöperation of soil nitrogen, it is nevertheless in the highest degree dangerous to expose them to this starvation cure, for in this way many individual plants are sacrificed. They are destroyed by pests, being too weak to replace losses caused by them; they dry up for lack of deep roots; they are attacked by fungous diseases, because their juices stagnate; or they starve out completely. Therefore, in such cases, and only such, the farmer should feed the starving plants a small quantity of nitrogen, either in form of Chili saltpetre or ammonia salts; but only a little, as much nitrogen salt would be an extravagance. A small application, of perhaps forty-five to sixty-seven pounds of Chili saltpetre per acre, can in such case be effective and remunerative; for it is simply necessary to assist the plants over that critical period, and to bring them as quickly as possible to a state of development in which they have the ability to draw nitrogen from the atmosphere.

Concerning nitrogen manuring proper, therefore, we have to discuss the question only with reference to the so called nitrogen consumers; and I now ask, With how much nitrogen shall we manure, in order to attain an increased yield giving the greatest possible net gain?

Here the answer is essentially different from that in the case of phosphoric acid and potash manuring. I state it thus: Soluble nitrogen is not to be offered to the plants in surplus, but is to be measured out to them as nearly as possible in needed quantities. If we assume that vegetation is governed by plant foods, then nitrogen is the real dictator in the matter of growth, with all plants requiring nitrogenous manure—that is, all nitrogen consumers. The nourishment of these plants, the application of food in proper quantity—indeed, the entire art of manuring—is dependent on a rational and exact application of nitrogen. The farmer applies all other plant foods in surplus, but nitrogen he deals out to the plants as he gives rations to his animals; and in this way regulates their productive activity, and gives them the power to realize the full benefit

of circumstances favorable to vegetation, such as qualities of soil, climate, weather, be they continuous or intermittent.

We had assumed the task of raising the yield of a wheat field by two thousand pounds of grain, and had observed that this required the crop to consume about twenty pounds phosphoric acid, thirty pounds potash, and sixty pounds nitrogen, more than was before necessary for the production of superficial substance (straw and grain). Further reflection led us to the conclusion that an exact calculation of the phosphoric acid and potash necessary in this case would be impossible and irrelevant. We understand, moreover, that it is simply necessary to supply the soil with an appropriate surplus of these foods, and this presents no great difficulty. The supply of the nitrogen, then, is the problem presented, and one requiring a different solution from that in the cases of potash and phosphoric acid.

In this case we can and must calculate closely. We can, since we know that the entire nitrogen brought into the soil in the form of saltpetre and ammonia salts is at the disposition of the plants; for the nitrogen in saltpetre (and also ammonia, after transformation to nitric acid) is not bound by the soil, but is as freely movable as the water of the soil.

On the other hand, we must figure closely with the nitrogen, and not apply it in surplus, because, first, nitrogen is costly, and with it we cannot be extravagant; secondly, any nitrogen residue remaining in the soil during the winter months becomes lost; thirdly, a too ample supply of easily soluble nitrogen causes both an abnormal development of the crop, and also, under certain circumstances, a harvest of inferior quality.

But the difficulty in reckoning the nitrogen necessary for a definite increase of yield is not great. We can for the present assume, so far as investigations now indicate, that, of every three pounds of saltpetre nitrogen brought into the soil, an average of two pounds enters into the composition of the crops. Consequently, if we are to obtain an increased yield, containing two pounds of nitrogen, we need simply to bring into the soil one and one half this amount; *i. e.*, three pounds of soluble nitrogen. In the case under consideration, therefore, sixty pounds of nitrogen being necessary to produce two thousand pounds of wheat grain plus three thousand pounds of wheat straw, it is evident that ninety pounds of nitrogen are to be brought into the soil, in order to obtain the desired increase.

An approximate reckoning of the nitrogen necessary in every case offers consequently no difficulty. Let us assume, on the one hand, that of the fifteen and one half pounds nitrogen in every one hundred pounds Chili saltpetre, about ten pounds serve in the production of the harvest. On the other hand, we know how much nitrogen is necessary to form every one hundred pounds grain, or beets, or potatoes, with corresponding straw and tops. We can now reckon what increased yield we can obtain by the application of every one hundred pounds Chili saltpetre, and thereby obtain data for determining the quantity of nitrogen to be applied, and also for judging of the result of the manuring. I have made use of tables published by Lierke, in computing in this manner for several crops, and give here the results of these computations. They show the following increased yields to be produced by applications in each instance of one hundred pounds Chili saltpetre:

Wheat	350 pounds grain and 500 pounds straw.
Rye	330 pounds grain and 850 pounds straw.
Barley	420 pounds grain and 600 pounds straw.
Oats	350 pounds grain and 580 pounds straw.
Corn	420 pounds grain and 580 pounds straw.
Buckwheat	420 pounds grain and 640 pounds straw.
Potatoes	2,600 pounds tubers and300 pounds leaves.
Sugar beets	4,500 pounds roots and 900 pounds leaves.
Fodder beets	3,900 pounds roots and 1,000 pounds leaves.
Carrots	3,700 pounds roots and 560 pounds leaves.
Chicory	3,400 pounds roots and 410 pounds leaves.
Meadow hay	645 pounds hay.
Corn fodder	5,300 pounds green fodder.
Rape	110 pounds grain and 600 pounds straw.
Hops	70 pounds heads and 820 pounds leaves and vines.
Tobacco	180 pounds leaves and 150 pounds stems.
Poppy	170 pounds seed and 500 pounds straw.

I also place here a second representation, which shows, in pounds per acre, the approximate limits within which it is customary to apply nitrogen in barnyard manuring:

	Nitrogen.	Corresponding to— Chili Saltpetre.	Sulphate of Ammonia.
Straw crops	13 to 53	89 to 356	67 to 267
Potatoes	22 to 45	143 to 294	—*
Sugar beets, carrots, and chicory	22 to 53	143 to 356	—*
Fodder beets	22 to 67	143 to 445	—*
Rape, turnips, poppy, and mustard	22 to 67	143 to 445	111 to 356
Tobacco	13 to 27	89 to 178	67 to 134

These extreme quantities, in connection with the previous table, will serve the agriculturist as approximations from which to reckon an actual case of nitrogen application. In my paper on nitrogen manuring† I explained at length how to make these calculations, and here will simply adduce a practical example. Let us assume that we are to increase the yield of a wheat field by application of Chili saltpetre; other conditions are favorable, the soil is rich in potash, and phosphoric acid is provided. How much Chili saltpetre must be applied? The above representation shows it to be customary to apply from eighty-nine to three hundred and fifty-six pounds Chili saltpetre per acre. These are wide limits. From the previous table we observe that an application of one hundred pounds Chili saltpetre indicates an increased yield of three hundred and fifty pounds grain; therefore, three hundred and fifty-six pounds saltpetre allows us to calculate a yield of one thousand two hundred and forty-six pounds of grain. In order to arrive at a result, we ask how much the field would produce without manure. This, of course, we cannot know exactly; but previous experience, knowledge of the condition of the soil and of the kind and quality of the foregoing crop, permit us to make an approximation. Assume that the crop would be two thousand pounds of grain per acre, how much can we increase this production? Here, again, it is impossible to know exactly; but, after considering the quality of the soil, the climate, the best harvests

* Not reckoned, because the ammonia salt manuring, for the potatoes and beets, proved to be far less effective than the saltpetre manuring.

† "The Increase in the Produce of the Soil through the Rational Use of Nitrogenous Manure." Translated by G. G. Henderson. Published in 1888, by Whitaker & Co., London.

which neighbors and others have reached by an intensive nitrogenous manuring, a certain amount may be stated, which can probably be produced. By application of three hundred and twenty pounds saltpetre we could calculate upon a yield increase of one thousand one hundred and twenty pounds, *i. e.*, of a harvest of three thousand one hundred and twenty pounds of grain; but now, should it be feared, in view of local conditions or previous experience, that this amount cannot be reached, we settle on two thousand eight hundred pounds, *i. e.*, an increased yield of eight hundred pounds of grain, and therefore on an application of two hundred and forty pounds Chili saltpetre.

Now, for determining the success of the experiment, two or three carefully measured plots are left without nitrogen application. The yield from these must be separately harvested and weighed, and from a comparison it may be seen whether or not the nitrogen application has produced the effect expected. If the result has fallen short of that—if, perhaps, instead of eight hundred pounds increase only six hundred and forty pounds have resulted—we must search for a cause. Perhaps there was a deficiency in potash, phosphoric acid, lime, water, or warmth, which prevented the full efficiency of the nitrogen; or perhaps the nitrogen applied could not be fully absorbed and assimilated, because of the influence of a heavy spring snow storm, for example, which washed the saltpetre into the subsoil. Perhaps the number of plants was too small, either because of meager seeding or destruction by late frosts; or there may have been too many plants—too much seed sown—and, because of crowding, their development was abnormal. The stand, becoming weak, suffered from deficiency of light, and lodged. Such questions must be raised and decision reached among these possibilities.

Should the cause be found by aid of further experiment, perhaps, then, must be considered how to neutralize it, in order to secure the legitimate effect of saltpetre application. If it proves to be beyond control, we consider whether less nitrogen may not bring greater profit. If those two hundred and forty pounds of Chili saltpetre fail of their full effect because of too dry soil, and if experience can give no hope for more moisture in following years, then it is highly probable that a smaller nitrogen application would be more profitable; and it is merely a matter of calculation to ascertain whether it is more advantageous to get full effect of a smaller manuring, or partial effect of a full manuring. It is not invariably true that the lesser application, although completely taken up, will furnish the highest net profit. Relatively, this would make the larger harvest. But a very important factor here is the absolute amount of gross return. Let us assume that a saltpetre application of four hundred and forty pounds, which costs about $10, gives an increased yield worth $25; and an application of eight hundred and eighty pounds, costing about $20, returns an increased yield not of $50, but of $40. Then the relative return from the smaller application is indeed greater, but less advantageous, for its net return amounts to $25, less $10, *i. e.*, $15; whereas, the heavier application furnishes a net profit of $40, less $20, *i. e.*, $20.

I believe now I have sufficiently explained the chief considerations suggested, in the application of artificial manures. These may be summarized as follows:

First—Artificial manures (phosphoric acid, potash, and nitrogenous

fertilizers) can effect an increase of yield when all other factors are either temporarily or permanently favorable.

Second—Phosphoric acid and potash are to be stored in the soil until a surplus is present; that is, until an excess beyond the demands of the most exhaustive crops is supplied.

Third—The nitrogen increasers (lupines, pease, clover, vetches, lucerne, etc.) need, under normal circumstances of cultivation, no fertilizing with nitrogen salts. Only on exceptionally poor soils can it be profitable to apply these, and in such cases the application should be small, and made during the first period of growth. This is for the purpose of bringing the plants, quickly and without disturbance, to that stage of development beyond which soil nitrogen is not needed, as the entire amount can be drawn from the air.

Fourth—The nitrogen consumers (straw, hoed and oil crops, flax, hemp, tobacco, etc.) require nitrogen manuring; but the nitrogen must not be applied in surplus, only in quantities which careful computation indicates necessary for a required increased yield of the crop in question.

We may now consider a few of the more special questions; and first of all, those connected with

PHOSPHORIC ACID MANURING.

Our cultivated crops must be given a surplus of phosphoric acid, *i. e.*, enough to produce, under any circumstances, the largest possible harvest. As has been said, this surplus must not be too great; it must not amount to a superfluity. If, year in and year out, considerably larger quantities of phosphoric acid are put into the field than the harvests remove, then a limit is gradually reached, beyond which a regular repetition of the same manuring would be irrational. When a sufficient supply of phosphoric acid is obtained, it should be held, but not increased. This is important, especially in manuring with easily soluble phosphates. Such phosphates, after application to the soil in surplus, become, from year to year, less soluble; whereas, surplus Thomas slag or bone meal becomes more soluble. It is, therefore, not necessary to be so cautious in applying the latter. They are cheaper, and gradually become more soluble; while dissolved phosphates are dearer, and gradually become less soluble.

An excessive surplus of phosphoric acid is not only an extravagance, but it is of disadvantage to the crop. The evil effects of heavy phosphoric manuring are indeed not yet proved with absolute certainty; but the probability is great, that under many circumstances they are actual. An explanation of this is not difficult to find. It is the same as that which I have given of the hastening effect of phosphoric acid in ripening.

Every farmer experienced in phosphate manuring knows that strong applications of phosphoric acid hasten the ripening process in cultivated plants, which are not supplied with a surplus quantity of nitrogen. The plants become yellow at an early stage, and ripen faster than those manured with surplus nitrogen. The cause of this phenomenon has been sought in a quickening effect, which phosphoric acid is supposed to exert on all the living functions of plants. Phosphoric acid is said to make the plants more vivacious. This, however, is not quite pertinent. A plant manured with a surplus of phosphoric acid does not, in my opinion, *live* faster, but *dies* faster. As is generally known, the so called

ripening process of a plant consists in a cessation of activity in the manufacture of vegetable material, at the same time the elaborated products scattered through leaves and stems are transferred to surface or (as in beets, potatoes, etc.) subterranean deposits—the so called fruits. This transferring process is disturbed and prolonged when the ripening plant is induced, by continued applications of highly nitrogenous food, to continue its productive activity. If nitrogen is lacking, this process is hastened. But when a plant is manured with much phosphoric acid, and in consequence of this has formed much plant material and consumed a correspondingly large amount of nitrogen, it is very apparent that the nitrogen supply of the soil is exhausted correspondingly early, and nitrogen starvation sets in much sooner than when phosphoric acid is not applied. Then the plant stops production, and allows the ripening process to be completed undisturbed. This is presumably the explanation of the so called injurious effect of phosphoric acid, which is claimed to be observed in cases of diminished, instead of increased, yield, after heavy applications of phosphate. In such cases, the very rapid development of the plant causes great consumption of water and nitrogen; consequently, hunger and thirst appear early, and operate injuriously. If more nitrogen should be applied, either at first or promptly after the rapid growth, the injurious effect of the phosphoric acid would not be apparent.

It is often stated that "heavy applications of phosphoric acid readily produce injury on poor, sandy soil." But it should be observed how this effect of the phosphoric acid is brought about. Primarily, the phosphoric acid acts by no means injuriously. Plants manured with superphosphate appear at first more vigorously developed than those unmanured. Not till later does this "condition disappear." Then the plants cease to develop, and their leaves become yellow. Hot and dry weather is usual at this time, and the plants die. They "ripen too early." The phosphoric acid has "burned" them, as is frequently said. This "burning" by phosphoric acid is nothing else than the consequence of early nitrogen starvation, with heat and drought. The small amount of nitrogen supplied by a sandy soil is quickly consumed by those plants requiring much phosphoric acid, and consequently much nitrogen. The plants then starve, and the effect of heat, drought, and other unfavorable circumstances on a starving plant is, of course, far more hurtful than on a well fed one. Here, then, is the explanation why a crop heavily manured with phosphoric acid finally yields, in spite of an early, luxuriant development, a lighter harvest than another which has not been so manured. It should be remembered that these "evil effects of phosphoric acid" can be avoided by application of nitrogen, either at the beginning or at any time before the critical period is passed. Nitrogen salts, or more gradually acting compounds, as barnyard manure, green manure, ground meat, fish, dried blood, etc., may serve in such cases.

Loss of interest on invested capital, danger of lessening the solubility of phosphoric acid applied, and a possibility of an injurious effect, are not the only considerations which warn us from excessive phosphoric acid manuring. We may well ask, here, whether a heavy surplus of phosphoric acid may not cause the plants to take up considerably more phosophoric acid than they need in the elaboration of vegetable substance—that is, to consume phosphoric acid as a luxury. Comprehensive experiments, which I have carried out, have led me to the following

results: So soon as the plant lacks nitrogen or other food, a luxurious consumption of phosphoric acid can take place. The plant then continually absorbs phosphoric acid from the soil, which it cannot assimilate because of the lack of nitrogen. But if nitrogen is not lacking, then the danger of absorption of unassimilable phosphoric acid is not a present one. Aside from any such reasons, the agriculturist must never allow his crops to lack food. Only under this condition can the highest yields be produced. This condition fulfilled, a luxurious consumption of phosphoric acid is impossible. It is further to be noticed that the variations in content of phosphoric acid of the crop are found chiefly in the straw; not at all, or only to a small extent, in the grain itself. In my experiments,* for example, while the amount of phosphoric acid in rye straw was raised from 15 to 41 per cent, that in the rye grain was only raised from .92 to 1.06 per cent. In practice this is important; for the grain alone is sold, while the straw and fodder remain largely on the farm. Therefore, if the field has produced a straw or fodder richer in phosphoric acid than would have corresponded to an economical consumption, this excess is not lost to the farm, but is transferred to the barnyard manure, and goes back to the soil.

On this account, also, it appears to me wise to furnish fodder crops especially with a not too meager surplus of phosphoric acid. These plants need much phosphoric acid for their development; and if too much is given them, and more than they need is taken up, then the barnyard manure is simply enriched thereby, and from the luxurious consumption no injury to the farm, other than the loss of interest, ensues.

This consideration brings us immediately to the following general question: Which domestic plants are to be manured with a large surplus, and which with a small surplus, of phosphoric acid? Investigations concerning this subject have unfortunately led to no conclusions. When one considers, for example, that rape must assimilate fifty-three pounds and barley only twenty-two pounds of phosphoric acid per acre, to furnish an average harvest, we are forced to think that rape should be given at least twice as much phosphoric acid as barley. But that is not the case. The necessary amount of manure cannot always be inferred from the necessary amount of food. The necessary amount of food for a plant, as determined by chemical analysis of the crop, is often essentially different from the amount of manure which the same needs, as determined by the fertilizer experiment. The same soil from which one domestic plant can take only twenty pounds of phosphoric acid, yields without difficulty sixty pounds to another. We must, therefore, determine the amount of manure to be given, not simply by the need of a crop for plant food, but with reference to the manurial need of the plant—that is, its demand for easily soluble materials.

As I have stated, the investigations on this highly important question have not yet led to conclusions; but I hope soon to report, in this connection, very interesting data. At present I simply advise agriculturists to apply phosphoric acid chiefly to the fodder crops, and by no means to allow the meadows, clover, lupine, esparcet, and vetch to lack phosphoric acid. Moreover, those crops which it is important to hasten in the ripening process, *e. g.*, sugar beets, potatoes, large fruits, and

* "The Manurial Value and Rational Application of Thomas Slag, in Comparison to Superphosphate, Bone Meal, Peruvian Guano, and Ground Coprolite." Darmstadt, 1888.

grapes, should be furnished a large surplus of phosphoric acid; and especially when, because of a cold soil, a slow ripening is feared. But, on the other hand, where the species of plant or condition of soil (dryness, warmth, deficiency of humus) hastens the ripening, then great caution is necessary, lest the surplus amount to an injurious excess.

Another question here arises, namely: In view of present ruling prices, of special aims in culture, and of special qualities of soil, which phosphate is it most advantageous to use? The principal commercial phosphates are superphosphate, including all dissolved phosphates (Peruvian guano, dissolved bone, etc.), ground Thomas slag, and bone meal. These have very different market prices. Phosphoric acid costs per pound, in superphosphates, from 6 to 7 cents; in bone meal, from 4 to 4.5 cents; in Thomas slag, from 2 to 2.5 cents. What is the explanation of this difference in price? Has the phosphoric acid a different value in the feeding of plants, according to whether it comes from superphosphates, Thomas slag, or bone meal? No. It makes no difference with the plant whether phosphoric acid comes to it from guano, bone meal, ground phosphorite, superphosphate, ground coprolite, Thomas slag, or any other manure.

Here, however, is the explanation: Phosphoric acid cannot be taken from every manure with equal rapidity; and the manurial value of a phosphate, as well as the market price of its phosphoric acid, is determined relatively by the rapidity with which the plant can draw from it the phosphoric acid. It is important for the agriculturist to get return from his outlay as quickly as possible. Therefore, it is important that phosphoric acid applied to the soil should become dissolved, enter into the roots, and in the form of vegetable substance be returned at the first possible moment. A manure whose phosphoric acid comes back in the first crop, is, of course, much more valuable than one which returns the last portions only after six, eight, or ten years. Therefore, the rapidity of the effect is all-important, if we would determine the manurial worth of ground Thomas slag relatively to that of superphosphate and bone meal. We must ascertain how rapidly the phosphates are decomposed and taken up by the plants. But how do we accomplish this? By what method can we determine the solubility of Thomas slag phosphoric acid? Here is apparently no difficulty. A large number of chemical solvents are at our disposal. We can treat the ground Thomas slag with dilute acetic acid, citric acid, ammonia citrate, etc., and prove whether it is more or less easily and quickly dissolved than other phosphates. In fact, it has been found that all such solvents decompose Thomas slag more quickly and completely than, for instance, the undissolved coprolite meal. But this by no means suffices for reckoning the manurial value of Thomas slag phosphoric acid. Remarkable as it is that Thomas slag is dissolved with relative ease in acetic acid, and probable as it appears that the manurial value of its phosphoric acid would be great, this is nevertheless not yet determined. In the soil there is no acetic acid, no ammonia citrate. There we have to do with the combined effect of several solvent powers which proceed from humic acid, soil water, various soil salts, and the acids of the plant roots. How these coöperating agents behave toward Thomas slag, bone meal, superphosphates, etc., must first be determined, in order to reach a definite and reliable statement as to the manurial value of Thomas slag. This testing can only be accomplished by fertilizer experiments.

Exact and reliable fertilizer experiments are unusually difficult of execution. Experiments in the open field, on half or quarter-acre plots, are very tiresome and unremunerative. The measuring and staking out of plots, the uniform division of the manure, the harvesting of separate small crops, with careful taking of all weights, is troublesome and expensive work; and, further, the lack of uniformity of soil, unfavorable weather, crop enemies above and below the surface, accidents from all sorts of animals, are factors which, in coöperation, render the results to a high degree uncertain and useless. By field experiments one can be led into the greatest errors, unless results are checked, carefully, by numerous repetitions with similarly fertilized plots. In view of this, I have, during a long series of years, elaborated a method by which fertilizer experiments may be carried out, on a small scale, in great number and in an exact and reliable manner. More than a thousand such experiments are annually conducted in Darmstadt. As my method is generally known, both in principle and detail, no further description will here be given.* We now pass to a consideration of some interesting results furnished by these experiments. A very large number of experiments,† which were carried out with three different domestic crops—wheat, barley, and flax—and two different kinds of soil, with a view to ascertain the effects of commercial phosphates, yielded the following results. In order to produce the increased yield, which every pound of phosphoric acid in superphosphate produces, in the crop following the manuring, there are necessary, two pounds phosphoric acid, in form of ground Thomas slag; or ten pounds phosphoric acid, in form of steamed bone meal; or ten pounds phosphoric acid, in form of ground coprolite.

This result is very important, for it shows with what surprising rapidity the Thomas slag becomes effective, in comparison with bone meal; and we may well be allowed to draw the following conclusions:

First—Different series of experiments have shown that two pounds of phosphoric acid in Thomas slag produce, in the first year after application, the same as one pound of soluble phosphoric acid. It is, therefore, more advantageous to apply the Thomas slag; for two pounds of phosphoric acid in this cost only 4.4 cents, while one pound of soluble acid costs from 6 to 7 cents.

Second—Two pounds of Thomas slag phosphoric acid produced the same increased yield in the first crop following the application as ten pounds of bone meal phosphoric acid. The bone meal, therefore, must be considered, in comparison with Thomas slag, a much dearer manure.

These are very important results, practically, but they are not sufficient. We do not yet know what manurial value the Thomas slag and the bone meal have, in comparison to superphosphates. It would be a great mistake to reckon the relative value of superphosphate, bone meal, and Thomas slag from the yields of the first crops raised after manuring. These yields only show the rapidity with which the different phosphates become effective. Their complete manurial value, or their relative market value, can only be determined after ascertaining the effects of each phosphate on the *succeeding* crops, as long, indeed, as any effect can be noticed. I have, therefore, by further experiments, also deter-

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* Information concerning my method is to be found in an essay entitled, "The Manurial Value and Rational Application of Thomas Slag," etc. Darmstadt, 1888.

† Minuter details in my paper above mentioned.

mined the after effect which the different phosphates are capable of exerting, during the second year after the manuring, on spring rye, turnips, and mustard. It was indeed to be foreseen, with considerable certainty, that the after effect of the Thomas slag would be greater than that of the superphosphates; for, on the one hand one hundred pounds of soluble phosphoric acid, and on the other two hundred pounds of Thomas slag phosphoric acid, were applied. In our experiments, sixty pounds of phosphoric acid are taken up from each manure; there then remains in the soil, of the one hundred pounds soluble phosphoric acid, only forty pounds, but of the two hundred pounds Thomas slag phosphoric acid, one hundred and forty pounds; and it is not otherwise possible than that the one hundred and forty pounds of Thomas slag phosphoric acid should effect very much more than the forty pounds of phosphoric acid in the superphosphate. This assumption was, in fact, proved by my further experiments.

In my above mentioned paper, on the manurial value of Thomas slag, relative to superphosphates, etc., I have given the results of a comprehensive series of experiments. From these I draw the following conclusions:

First—Two pounds of Thomas slag phosphoric acid (applied in the form of ground Thomas slag, containing 18 per cent phosphoric acid and 80 per cent fine powder) produced, the first year after manuring, the same increase of yield as one pound of soluble phosphoric acid.

Second—The after effect of the two pounds of Thomas slag phosphoric acid, in the second year after manuring, was twice that of the one pound of soluble phosphoric acid. If, now, we allow the increased yield produced by one pound of soluble phosphoric acid to be indicated by 100, then two pounds of Thomas slag phosphoric acid effected, in the first year after manuring, a yield increase of one hundred. In the first and second years after manuring, the increase was one hundred and twenty. On the other hand, two pounds of bone meal phosphoric acid produced, in the first year after manuring, an increase of ten, and in the first and second years after manuring, an increase of twenty-two.

These results show that, at present quoted prices, it is much more profitable to use ground Thomas slag as a manure than bone meal. Bone meal becomes effective very slowly, while even the coarse meal (the residue from sifting) of the Thomas slag acts more quickly. The results of my experiments, which have been subjected to rigid scrutiny, as well as the favorable experience of agriculturists generally, induce me to recommend very highly the use of ground Thomas slag. It should, however, be procured from a reliable source, the percentage of phosphoric acid and of fine meal should be guaranteed, and a sample of the material received examined for phosphoric acid and fine meal at the proper experiment station. These ingredients vary greatly in commercial wares. If the Thomas slag has less fine meal than corresponds to the normal of 80 per cent, it acts more slowly, and has therefore less value. Apparently, also, the phosphoric acid in a meal richer in this material, and consequently containing less lime, becomes active more quickly than the corresponding quantity in a meal with more lime and less phosphoric acid. My experiments in this connection are not yet concluded. I shall, however, soon report more definitely upon it.

Ground Thomas slag may be applied to all crops, so far as present experience indicates. A distinction is to be made, however, in its action

in different places. Much better effect is noticed on clover and meadows, for example, than on sugar beets and spring grain crops. As the yearly quantity of slag obtainable can only cover a small part of the demand for phosphoric acid, and as we must now, as formerly, supply our principal need from the superphosphate factories, I will here indicate the most profitable disposition of these two phosphoric acid manures. I believe the quantity of ground Thomas slag yearly offered should be applied primarily on moor and meadow soils, of not too dry character, and then respectively on the heavy sand soils, all lighter loam and sand soils, and finally on the fields for fodder crops, clover and lucerne, winter crops, etc. This use would soon consume the three to four million hundredweight of ground slag annually offered by the German manure market, and this amount would not cover the special cases named. For what remains, and for beets, potatoes, spring grain crops, the lime and heavy clay soils, superphosphate should be taken. Wherever the soil conditions favor the decomposition of phosphates (in moors, meadows, moist and humus fields), or where it is wished to store a supply of phosphoric acid for several years (fodder fields, vineyards, orchards), or where, finally, cultivated crops are to be raised, which are to be distinguished by relatively long vegetative periods (winter crops, perennial fodder crops), there the phosphates which become soluble with difficulty, and which become active more slowly, are to be applied. The dissolved phosphates, *i. e.*, those acting more quickly, are, on the other hand, to be chosen under opposite circumstances. As a matter of course, prices and freight expenses must be brought into the calculation. If a choice must be made among the commercial phosphates offered, it should be remembered, for example, that the ground slag is considerably dearer for those places remote from the grinding mills. In such cases, superphosphates, especially the double superphosphate, which costs the least in transportation, may be applied more profitably than the Thomas slag.

MANURING WITH POTASH SALTS.

Unfortunately, the very important subject of potash manuring is at present but little investigated. Which domestic plants are most in need of potash; how heavy applications can be made without injury; in which cases it is better to apply potassium chloride, and in which potassium sulphate; what the chief and what the secondary actions of the crude salts, kainite and carnallite, are—of all this we know nearly nothing as yet. What little we do know can be expressed in a few words. I will present the following brief statements: Rich potash soils, that is, those not needing potash salts, are not so rare as those not needing phosphoric acid; and it can in general be assumed that the lighter soils are more destitute of potash than the heavier ones. The soils first to be supplied with potash are the moors. They are generally so devoid of potash, that, without heavy kainite manuring or its equivalent, no satisfactory yields are to be obtained from them.

Whether it is better to apply the crude salts (kainite and carnallite), or whether the pure and concentrated salts (potassium chloride and potassa sulphate), must be decided in the first place by the price at which the pound of potash is to be had in the different materials. Potash in local salt deposits is much cheaper in the crude than in the

concentrated forms. As, however, the latter contain three or four times as much as the former, the freight on the raw salts amounts to three or four times that on the concentrated. Consequently, beyond a certain distance, the potash of purified salts is much cheaper than that of the crude salt.

In deciding this question, moreover, it must be remembered that the common salt (sodium chloride) of the crude preparations has a binding effect on the soil, and increases its power to retain water. It is this effect of crude salts which improves the character of light soils, but which, on the other hand, deteriorates heavy soils already possessed of too much binding quality. It is not advisable, therefore, to manure heavy soils with kainite or carnallite.

Again, it must not be forgotten that plants appear to be sensitive—some in a greater degree, some less—to concentrated solutions of chlorides. It is best, therefore, in the application of raw salts containing much chlorine, to spread them in autumn, or as early as possible in the spring. They will then exist in sufficiently dilute solutions in the soil before they come in contact with the growing plants. Whether it is true that potash salts, containing chlorine, have an unfavorable effect on the quality of many crops, is yet doubtful. It is only proved in the case of tobacco, which it is better to manure with potassa sulphate, or still better with potassa phosphate, than with kainite. As has already been said, if the soil needs potash, it should be given enough so that a surplus will always be present. But it must be remembered that plants are much more sensitive to an excess of potash salts than to an excess of phosphoric acid.

Potash salts also must be applied with more caution than phosphates. Manurings of six hundred and twenty pounds kainite, or one hundred and thirty-five to one hundred and eighty pounds potassium chloride, or corresponding quantities of other salts, are to be regarded as very strong applications. Concentrated solutions in the soil appear to be specially detrimental to beets and potatoes, on account of which it is customary to apply potash, in such cases, to the preceding crop.

Potash salts have an unusual importance in the manuring of the nitrogen increasers; *e. g.*, varieties of clover, pease, vetches, esparcet, etc., as well as meadows. The general practice in manuring meadows is bad. Not enough plant food is applied, and the manuring is not done rationally. The spreading of liquid manure, on such fields, is in many cases irrational. Economical considerations may often seem to compel this practice. It may not be known how otherwise to dispose of this material; but it must be remembered that the nitrogen of liquid manure renders poor service in meadows. On corn, fodder beets, rape, winter grain, and in orchards, this nitrogen accomplishes very much more. Meadows have no particular need of nitrogen manuring. They are in this respect independent. If simply a potash and phosphoric acid manure be applied to a meadow, its vegetation accommodates itself to this condition of things. Vetch varieties, clover, and similar plants then grow luxuriantly; they need no nitrogen manuring, for they take from soil and air enough to supply their entire need. A "grass meadow" is converted by potash and phosphoric acid manuring into a vetch and clover meadow. A meadow suffering neither from superfluity nor lack of water, manured with Thomas slag (during the first years about seven hundred pounds per acre, afterward less, and kainite four hun-

dred and fifty to five hundred and sixty pounds per acre), often produces astonishing yields and an improved quality of fodder. Improved grasses and clover plants increase after such a manuring. In general, it is of the greatest importance to manure clover, pease, vetches, lucerne, and all nitrogen increasers, with much potash and phosphoric acid.

As proof of the luxuriance with which the nitrogen increasers grow, even upon soils with little nitrogen, when supplied with an abundance of potash and phosphoric acid, I cite here from my experiments the following example: On plots containing very little nitrogen, vetches and pease were sown, in August, during three successive years. In late autumn the green growth was turned under, and then crops of spring rye grown. These plowed-in crops grew with extraordinary luxuriance under careful cultivation, and with rich phosphoric acid and potash application. They furnished, in three successive years, about one hundred and seventy-eight pounds atmospheric nitrogen per acre in their surface growth, and thereby increased the rye harvest, in round figures, two thousand nine hundred and forty pounds of grain, and six thousand six hundred and eighty pounds of straw per acre.

This experiment shows with what luxuriance pease and vetches can grow without nitrogen manuring, on soils poor in nitrogen (but well supplied with phosphoric acid and potash), even when the nitrogen collected is continually removed from the soil in the chief crop. The power of these plants for collecting nitrogen is extremely great; and the sooner they can be satisfied with phosphoric acid and potash, just so much more quickly and vigorously do they take up atmospheric nitrogen. It is impossible to emphasize sufficiently the importance of amply furnishing these plants with phosphoric acid and potash, and sometimes even with lime. It must be apparent that the potash manuring of nitrogen increasers is far more profitable than that of nitrogen consumers. With the former, potash and phosphoric acid alone produce an increased yield; while, for the latter, nitrogen in addition must be bought and applied, and the profitableness of phosphoric acid and potash manuring thereby diminished.

Since the year 1887 I have begun a method of larger experiments concerning the different questions in potash manuring, and hope shortly to communicate important results in this connection.

MANURING WITH NITROGEN.

We have already considered the method for determining the proper amount of nitrogen for application in any particular case, and have here to consider simply the selection of manures and the best methods of applying them. Unquestionably, the atmosphere furnishes the cheapest nitrogen manure. It is a free gift. The farmer has it for the mere asking; and, as we have seen, an entire series of cultivated crops are capable of drawing from this ever-flowing source, with as much ease as from the nitrogen compounds of a richly fertilized soil. We possess in these plants a means by which we can increase the circulating nitrogen capital of the farm. With them we can replace the deficit caused yearly by the exportation of nitrogenous products; by the losses incidental to the collection and preservation of animal excrements; by the evaporation of soil nitrogen into the air, and by filtration through the subsoil.

Schultz, of Lupitz, deserves high recognition for having attracted gen-

eral attention to the importance of utilizing atmospheric nitrogen, and of manuring the soil with nitrogen-collecting plants. He and Neuhaus, of Selchow, have shown, at once, the practicability of this process, and, in a most convincing manner, the great financial advantages which accrue to the farmer, who, whenever possible, feeds his plants with nitrogen from the air, and fertilizes his soil with atmospheric nitrogen.

I will briefly indicate the methods by which atmospheric nitrogen may thus be rendered useful:

1. Cultivate nitrogen-collecting plants as the chief crop, and turn under the entire harvest material as manure for the growth of the year following. This method causes the loss of an entire year's harvest, and is therefore applied only on light, dry, sandy soils.

2. Let clover and other leguminous varieties compose the chief crop to be harvested, of which the stubble and roots remain as manure for the succeeding crop.

3. Sow lupines, serradella, and clover varieties with the chief growth, consisting of some straw crop; and after harvest of the grain, plow under the growing plants, either in late autumn or in early spring.

4. Sow vetches, etc., in the *rolled* stubble of the harvested chief growth, and plow under in late autumn or early spring.

5. Sow Italian clover in the rolled stubble of the chief growth. In May, a fodder crop having been cut, the piece is plowed, and then the stubble and roots remain as manure for potatoes, fodder, beets, rutabagas, etc.

Method No. 3 is particularly recommended, and is chiefly applicable to rye culture, on soils of medium quality (loamy sand and sandy loam).

Mr. Neuhaus, of Selchow, who has had valuable experience in this process of culture, sows with machine in April, or beginning of May, from thirty-five to fifty-five pounds per acre, of good serradella seed. This is sown in the straw crop (rye, oats, or barley) when about six inches high. If not machine-sown, the seed must be covered by harrowing. In order to have the ground well covered, and to succeed with at least one of the so called intermediate crops, there are still thrown onto this ninety pounds of lupine seed, about the time when the rye is in flower, in case of a heavy stand; but, if this is thin, then later. The lupine seed lying on the surface must of course have rain, in order to sprout. In case of heavy drought, this sprouting is not satisfactory. But Mr. Neuhaus states that he has had poor success not oftener than once in six or seven years. In view of the slight cost of the seed, and of such possible great advantage, this is indeed no great risk. At the time of the grain harvest, the plants of the last sowing will have so far developed as not to be injured by the cutting, if the stubble is left somewhat long. If the autumn is exceptionally dry, they develop very luxuriantly, and in favorable years furnish a crop which, according to Mr. Neuhaus, corresponds (including the root mass) to not less than one hundred and twenty-five pounds of nitrogen per acre; that is, as much nitrogen as is contained in twenty-five thousand pounds of barnyard manure. In addition to this, experiments have shown me that nitrogen in green plant material acts much more quickly than that contained in barnyard manure.

As far as possible, therefore, the agriculturist must fully utilize the atmospheric source of nitrogen, and, by rich applications of phosphoric acid and potash, put the crops in position to take the largest possible

amount of nitrogen from the air. Plenty of water, plenty of phosphoric acid, potash, and lime; these are the demands made by the nitrogen-collecting plants on the soil. The nitrogen they provide themselves; and yet, for intensive farming, for an intensive culture of roots, grain, and oil crops, tobacco, potatoes, etc., the nitrogen possible from the air is not sufficient.

Commercial nitrogenous manures must come in here, to aid in reaching the highest possible net profit. Of these, Chili saltpetre and ammonia sulphate are by far the most important, for they appear in the market in much the greater quantities. Peruvian guano, with a high percentage of nitrogen, has become very scarce; and dried blood, ground horn, fish and meat, wool refuse, and ground leather, appear in the market in relatively insignificant quantities.

Nevertheless, the question as to the manurial value of the latter, that is, of organic nitrogen manures, is important enough to demand careful and exact investigation. I therefore arranged, in the summer of 1887, an interesting series of experiments intended to show:

(*a*) How quickly the nitrogen of these manures become active.

(*b*) How much nitrogen, in form of ground bone, dried blood, wool waste, etc., must be applied in the primary and after-manurings, in order to reach the same yearly effect which is obtained with one hundred pounds of Chili saltpetre.

(*c*) How much of the nitrogen brought into the soil, in these manures, is really available for plant feeding, and how much, on the other hand, becomes lost (as free nitrogen) by chemical decomposition.

These questions it was intended to solve by using marled and unmarled soils; and I hope to obtain, in the course of a few years, practical, valuable results. Experiments already made elsewhere have, unfortunately, not furnished sufficient data for the determination of the relative value of the manures in question. They have in every instance been executed during only one year. The after effects of the organic nitrogen manures have thus been left out of consideration; and, moreover, the results exhibit important contradictions. The only definite statements that can now be made are these: Dried blood and ground horn decompose more quickly than ground fish, ground meal, or bone meal. The decomposition of wool waste and ground leather proceeds very slowly. It is impossible, at present, to make definite numerical statements. The prices which it is customary to pay for the slowly decomposing nitrogen manures are proved to be too high in comparison with that of saltpetre and ammonia. Toward the close of 1889 I shall probably be able to communicate more in detail concerning my work in this connection.

The relative value of nitrogen in ammonia and saltpetre is also as yet undetermined. In comparative field experiments it has been found that the increase of yield, after manuring with ammonia sulphate, is sometimes higher and sometimes considerably less than that obtained after the corresponding manuring with saltpetre. In a majority of cases the ammonia manuring with sugar beets and potatoes has shown such poor results, in comparison with saltpetre manuring, that it is rejected as too unsafe for these crops. Chili saltpetre alone is recommended as a nitrogen manure for them, while with straw crops a still more unfavorable record has been obtained from ammonia salts.

No satisfactory conclusions have yet been reached from the field

experiments, for the variations in results have been unusually great. If we represent the increased yield obtained with saltpetre nitrogen by one hundred, the corresponding results from ammonia manuring would give eighty-three, one hundred, one hundred and fifteen, and one hundred and forty-four; and then, again, forty-six, forty-seven, and forty-three. These are examples of what has been obtained with grains. A cause for such differences has not been discovered; and, indeed, it is not known whether the differences are reliable, or really due to difference in action of saltpetre nitrogen and ammonia nitrogen.

I have during the last two years carried on, and to some extent completed, quite comprehensive experiments on the effect of ammonia manuring in relation to saltpetre manuring. I have attempted to determine the magnitude of the difference between the effects of the nitrogen salts in question, and to explain the causes of the different effects. The following brief notes are taken from the results of my work:

1. Experiments with grass, oats, rye, buckwheat, and turnips, on loam soil containing a small percentage of lime carbonate, show, for the most part, no considerable difference between the action of ammonia and saltpetre, when the manuring was done in the spring, and immediately before sowing. To what extent the lime carbonate exerted an influence on the effectiveness of the ammonia, or whether it exerted an influence at all, I do not know. I am still to test this. In several series of experiments the effect of the ammonia nitrogen was precisely equivalent to that of saltpetre. In several cases the ammonia nitrogen effected somewhat more than the saltpetre, while in others the ammonia effect was from 10 to 15 per cent less than that of saltpetre. The causes of these differences have not yet been determined.

2. On a soil consisting of equal weights of loam and acid (mossy) turf, the effect of the ammonia manure was very late and slight, in comparison with that of the saltpetre manure. On the same soil, mixed with lime marl, the ammonia effect was from beginning to end precisely that of the saltpetre.

3. It has been supposed that the sulphuric acid, combined with the ammonia, acts disadvantageously on the plants, and to this the average lesser effect of the ammonia nitrogen is due. This is not the case, at least under all circumstances. Even exceptionally heavy applications, if not less than two hundred and sixty-seven pounds nitrogen per acre, furnished the same yield of oats and wheat, when in form of ammonia sulphate, as when in form of ammonia carbonate or nitrate.

4. On calcareous loam, very heavy manurings of ammonia nitrogen acted with equal rapidity to corresponding applications of saltpetre nitrogen. Under the condition of heavy and continuous rains, shortly after seed sowing, when the saltpetre was washed through the soil, and, for the time being, removed from the plant roots, the ammonia nitrogen produced quicker effect than the Chili saltpetre.

5. It has often been emphasized that ammonia, as such, before being transformed to nitric acid, can work injuriously on the plants. This may be, and it is possible that the sensitiveness of plants to ammonia is very variable. It is possible that the unsatisfactory experience thus far had in ammonia manuring, especially with roots and potatoes, is due to a particular sensitiveness of these very plants to ammonia. It is, however, singular that actual cases of damage (manifested by yellow color and scanty development of the plants) do not appear regularly

after very heavy ammonia manuring, but occur only rarely, and as exceptions. It is this irregularity in the appearance of an adverse effect, either slight or considerable, of ammonia manuring, which has induced me to advise caution in the application of ammonia sulphate, and to point out the slight value of average statements calculated from the results of field experiments.

6. It is remarkable that I obtained, repeatedly, after application of ammonia salts, considerably smaller yields than after saltpetre manuring. This the following experiment shows:

Oats were manured with ammonia sulphate, carbonate, and nitrate, and a mean of 20.3 ounces of harvest was obtained, the results mutually agreeing. The corresponding saltpetre manuring yielded 21.1 ounces. With no manure, a harvest of 9.4 ounces was obtained.

A crop of turnips (harvested early) followed the oats in the same year. The same nitrogen compounds were applied on the corresponding plots, as in the case of the oats. The ammonia salts furnished an average of 3.5 ounces of material; the Chili saltpetre, on the contrary, 4.8 ounces in excess of the unmanured. Saltpetre nitrogen thus produced a third more than the ammonia nitrogen. The cause of this result could have been that the soil conditions were unfavorable for the action of the ammonia, or that the ammonia had yielded less to the turnips than to the oats. In order to settle this question, plots were laid out in the the following year, sown with oats, and the respective nitrogen manures applied. It was then clear that the ammonia salts produced less than the saltpetre, even with the oats. The yield with saltpetre was 20 per cent more than that with the ammonia salts.

It is here apparent that the kind of crop did not cause the slighter effect of the ammonia, but changes in the soil conditions must have brought about the superior effect of the Chili saltpetre with the second or third crop.

The character of these changes must still be investigated. I will here call attention to one point, namely: that the soda of the saltpetre exerts a certain influence on the physical character of the soil. In reacting with the lime carbonate of the soil, soda carbonate is formed, which, by superficial attraction, is bound to the soil. This holds the soil particles more firmly together, and increases their water-retaining power. It was long ago discovered that saltpetre manuring tends to increase the crusting of soils, and at the same time their water-retaining power. No explanation has ever been given. It has simply been spoken of as an effect of saltpetre, with no further question as to a cause.

Now, we know that this is due to the soda, and also that a secondary and similar effect of the saltpetre must appear, whenever it is applied in quantities so large that the plants can no longer consume the soda. Investigations in this direction are certainly to be recommended. They are apparently destined to throw much light on many cases in which applications of saltpetre result more favorably than those of ammonia. The same behavior is noticeable with kainite. Kainite consists of one third sodium chloride; and, in consequence of this sodium content, it acts very favorably on light soils. It occasions the soil particles to adhere more, and increases their water-retaining power. In England, also, the superior effect of saltpetre over ammonia, in repeated heavy manurings, has been determined. At first, even for several successive years, the ammonia effected more than the saltpetre. Then this rela-

tion was reversed, and in the succeeding years the saltpetre produced regularly, and often considerably, more than the ammonia. In this entire question nothing is clearly understood. We do not yet know the factors which occasion the transformation of ammonia into nitric acid, which favor or which hinder. So long as we are ignorant of this, and investigations present such totally contradictory results, no conclusions can be drawn. Until the fundamental questions concerning the application of ammonia and its action in the soil are answered, we must defer any further explanation of the difference in action between saltpetre and ammonia manures. Nothing permanent and useful, at least, can be built on the present swaying foundation. Clear and definite knowledge as to transformation of ammonia in the soil is wanted. At present, I can only offer, as reliable, the statement that ammonia manuring effects very little in acid turf or humus soils, unless the same are previously treated with marl or lime.

We may now consider the application of Chili saltpetre. This salt contains nitrogen in a form which allows immediate absorption and assimilation. It is not subject to the absorbing powers of the soil, but remains perfectly free, and therefore becomes quickly effective. A plant lacking nitrogen, watered with a solution of saltpetre, shows, three days afterwards, the effect of the nitrogen applied. Its leaves become dark green—a sign of luxuriant growth. Chili saltpetre presents to us, therefore, as does no other nitrogen manure, a means with which to influence quickly the development of plants. By sowing saltpetre on a young crop which has perhaps suffered from frost or insect attacks, the plants are induced to sturdy and luxuriant growth. Even at a later period of vegetation, if necessary, we can give them nitrogen food in this immediately assimilable form. Although we possess in Chili saltpetre a manure freely movable in the soil, immediately effective for the plant, and which is absorbed with great avidity, precaution in its use must be observed, otherwise the best effect possible is not secured. But whatever may be true here, is of equal importance in the case of ammonia. Under normal circumstances, ammonia is converted with more or less rapidity into nitric acid (*i. e.*, the form of nitrogen in saltpetre), and then has all its properties.

Failures in manuring with nitrogen salts sometimes occur. We will seek a brief explanation of these failures and means for their prevention. In the first place, the nitrogen is often not sufficiently absorbed by the plant. This can be the case when saltpetre is not applied at the right time. Winter grain may be manured in the autumn, in many cases successfully, but in many others not. It must be remembered that young plants require relatively little nitrogen for a sufficient development before the winter rest begins. A well cultivated soil furnishes quite enough for this. In the experiments of Heine, of Emersleben, the highest yields were furnished by those wheat fields which received no nitrogen manuring in autumn, and all their saltpetre in May. It is certainly incorrect to furnish the plant its entire supply of nitrogen in the fall; only sufficient should then be given for absorption and assimilation before the commencement of the winter rest. A surplus is unnecessary, and it may become entirely lost during the winter months by filtration through the subsoil.

Ammonia, also, as my experiments have shown, is in danger of draining into the lower layers of the field. Although at first it may be com-

bined with the finer soil particles, it is, nevertheless, converted into nitric acid, and this follows the course of the rain water, which, during the winter months, is forced through the ground. Only on very deep and retentive soils should a large application of nitrogen salts be risked in the fall. This danger of loss of nitrogen by percolation attends not only autumn applications, but those made at any time. Saltpetre nitrogen in the soil is in a condition of perfect freedom. It follows, consequently, the course of the percolating waters; therefore, the danger of loss of nitrogen by drainage increases with (*a*) the length of time between the application of the manure and the absorption of the nitrogen by the crop; (*b*) the quantity of manure applied; (*c*) the percolation in the soil; (*d*) the rainfall immediately after application.

If, now, the saltpetre is applied by sowing in the field after the plants have appeared, so that they quickly absorb it, the danger of percolation is only slight, or none at all. Fear is often entertained that if saltpetre is applied in this manner, the nitrogen will be supplied to the plants too late. On this account it is recommended to do away with such an application entirely for crops which must be ripened as early as possible; as, for example, sugar beets and potatoes, and to make use of it only as an after-manuring on the straw crops.

This rule is probably applicable in many cases, but the deeper we investigate the domain covered by the question in hand, the nearer we come to the conclusion that any rule must often be modified to suit a particular case. It is frequently desired to supply a crop with nitrogen at the earliest possible moment, and with the least possible waste. This cannot always be accomplished by manuring with saltpetre at the time of seeding. It cannot be done, for example, with spring grains, sugar beets, potatoes, carrots, turnips, flax, etc.

After the seed is sown, about eight days elapse with turnips and flax, ten to twelve with straw crops, two to three weeks with carrots and beets, and three to four weeks with potatoes, before the plants show themselves, and from that time, again, four to eight days pass before the young plants are capable of assimilating saltpetre nitrogen. If, now, during these periods there is a great fall of rain, and the water-retaining power of the soil is slight, the saltpetre is washed into the lower soil strata, and, in consequence, is removed from the plant roots. Sometimes it only becomes effective two weeks later than the ammonia salt, which is, as it were, held fast in the soil. This I have very often observed, and that, moreover, a part may entirely escape absorption by the plant roots. This danger is very considerable in cases of slowly germinating seeds. Saltpetre applied in my experiments with carrots the day before the sowing, effected very little, but a marked effect was produced when it was sown on the plot after the first carrot plants appeared. When a heavy saltpetre manuring is given, the entire quantity can be absorbed only gradually; but, until it is all absorbed, the residue in the soil is exposed to loss through drainage. In view of these conditions, it is doubtful if the application of Chili saltpetre, especially the quantity necessary for the crop, immediately before the sowing of spring crops, is, under all circumstances, the most rational.

Between the two extremes of applying all of the nitrogen before seeding, and all after the plants appear, there is indeed a series of intermediate procedures. The saltpetre can be sprinkled over the soil immediately after seeding, or one or two weeks later; or a part can be sown with the seed,

and the other part sooner or later afterwards. The latter way is advisable, especially when large amounts of nitrogen, not so quickly assimilable by the plants, are to be given. The opinion is often heard, that nitrogen promotes leaf formation, that it increases the amount of straw, and tends to cause the plants to lodge, while phosphoric acid acts in an opposite direction. This, as is shown in my paper above cited, cannot be correct. A specific effect of nitrogen, in an abnormal leaf development, exists just as little as does one of phosphoric acid in an abnormal development of the grain.

If, after saltpetre manuring the straw yield is increased out of proportion to the grain, the explanation is simply that the saltpetre hastened the first development of the plant, established healthy and strong stalks, but was not present in sufficient quantity to support, in like manner, the later development of the seed heads. During the first stages the plant was supplied with the richest food, but afterwards the need for nitrogen was not met; and, in consequence, much straw and little grain was yielded. It must be remembered that saltpetre is very rapidly taken up by plants, very rapidly assimilated, and occasions not a gradual, steady development, but a tendency to quick, luxuriant growth. If a normal development of straw is to be had, a one-sided development avoided, the nitrogen feeding of plants must be so regulated as to correspond, as nearly as possible, to the conditions in an old, humus-rich, strong soil. It should be remembered that the important period of nourishment comes at the stage of development just after the setting of the stalks.

The greatest possible yield of grain with the least possible number of stalks is the aim in an economical nitrogen-feeding of straw crops. The stem-setting of the grain crops is confined to a definite period in their process of development. When this is ended, there is no longer an increase in the number of stems. A nitrogen manure, now assimilated, only develops and strengthens the stems, and feeds the entire plant; while if supplied during or before the stem-setting, it increases the number of stalks. From this we can draw the following rule: Soluble nitrogen should be given to the straw crops, before the close of the stem-setting period, only in the quantity necessary to produce the requisite number of stems. After this period, so much is to be given as is necessary for the most healthy development possible of stem and grain.

I know well that the rule is more easily made than followed, and that the weather can readily neutralize the farmer's most intelligent efforts. But we must be clear in theory. How far it may be practicable to answer the theoretical conditions is quite another question. Let us apply the rule in a few examples. If a soil is in good cultivation, rich in nitrogen from residues of pease or clover, then it will not generally be advisable to assist the stem-setting of the plants, either by an addition of saltpetre or ammonia salts, or, if at all, by a very slight one. The soil will furnish enough nitrogen for an adequate stem formation, and an application should only be made after the completion of the stem-setting. Then a much heavier quantity can be given, and without the danger of lodging, which would have attended an earlier application.

Heine, of Emersleben,* had the following experience in manuring winter wheat. With much hesitation he determined to apply to his winter wheat no nitrogen in the fall, and none before the first of May.

* "Deutsche Landwirtschaftliche Presse," 1886, No. 33.

But the success of this procedure was greater than those in which applications were made in autumn, February, March, or even April. In this connection, Heine says: "The question, At what time shall saltpetre be sown? is answered by my results in a manner which completely overturns the opinions hitherto held. The opinion that Chili saltpetre must be sown over the winter wheat as soon as possible in spring is by no means confirmed. On the contrary, the Chili saltpetre applied at the beginning of May, even when the plants were very far developed, increased the yield of grain."

As a matter of course, this does not imply that an application in May is, everywhere and in all cases, the best for winter wheat. Such a pedantic prescription would by no means answer the principles laid down. Another example, in which it would be necessary to proceed in an entirely different manner, is the following: Assume that we have a soil much exhausted of nitrogen, and have calculated that a manuring of one thousand pounds Chili saltpetre is necessary to obtain a maximum yield of wheat. If, now, we should apply the thousand pounds saltpetre in May, the result would be a miserable failure. The plants would, up to this period, suffer starvation, and the stem-setting would be very small. On the other hand, if the entire quantity were sown in autumn or early spring, the result would be equally poor. The larger part of the easily soluble nitrogen would accomplish the stem-setting in such a manner as to induce early lodging. A proper division of the nitrogen manure—an application of two hundred pounds in the fall, four hundred pounds in March, and four hundred pounds in May—would be the correct procedure.

Not infrequently such a case as the following appears: The soil being poor in nitrogen, by an application of saltpetre the maximum yield is attempted, but not secured. The large quantity of saltpetre has caused the crop to lodge. But lodging is only produced by the growth of too great a number of stems, forced on by too early nourishment of the plant. If the heavy manuring comes after the stem-setting, then the stems will not stand so close; they will have plenty of light, they will develop more healthily, stand upright, and furnish full heads. A necessary condition here is a soil well enriched with phosphoric acid and, of course, sufficient potash. The later the nitrogen is given, just so much more quickly must it be assimilated; and in order to do its work, the plant must be able to take up large quantities of phosphoric acid in a very short space of time.

A further study of many questions, very important in the application of nitrogen manures, would lead us away from our present purpose. I must refer to my often quoted paper, and also to future publications in which I hope to give many practical results of my investigations. I emphasize once more that the greatest importance must be placed on the rational nitrogen manuring of plants. This is the central point in the entire doctrine of manuring.

Nitrogen holds, in plant life and in the economy of field culture, an entirely different position from potash, phosphoric acid, lime, or any other plant food. Nitrogen is indeed an organic constituent of plant substance, while phosphoric acid, potash, lime, etc., are only agents in the formative processes of organic substance, and only in the capacity necessary. Nitrogen, in the burning plant material, flies away; while phosphoric acid, potash, lime, magnesia, etc., remain behind as ash con-

stituents. But the nitrogen also comes and goes by slower processes. It wanders from the air into the soil, and from the soil into the air. Again, it passes from the atmosphere into the plant, and from the plant, when it decays, into the atmosphere. It is continually passing from the free condition into the chemically combined, and as constantly again becoming free.

The three most important and difficult tasks in manuring are, to catch the nitrogen, to hold it, and then to obtain from it the greatest possible service. It is, in the meantime, the important and urgent task of scientific investigation to further and further discover the laws which govern the movements and changes of nitrogen; for a knowledge of such laws will enable the farmer, in a large measure, to control these phenomena, and with the least possible expense to acquire the greatest net profit.

FRUIT CULTURE IN HUMBOLDT COUNTY.

ROHNERVILLE, CAL., September 17, 1890.

Mr. B. M. LELONG, *Secretary State Board of Horticulture:*

DEAR SIR: In accordance with your letter of instructions, I beg leave to submit this brief report upon the fruits, varieties, etc., grown in this part of the State. I hope that due allowance will be made for its imperfections, as this district is very large and considerable time is required to collect the desired information.

Yours truly,

A. P. CAMPTON.

APPLE.

The apple is grown throughout the whole of the northwestern part of the State, from the low lands along the coast to an altitude of near four thousand feet in the Coast Range. This portion of the State appears to be particularly adapted to the growth of this fruit; the tree grows very strong and the fruit is all that can be desired.

The apple varies in appearance, flavor, and keeping quality, according to the locality in which it is grown. The Rhode Island Greening of lower Eel River Valley is of medium size and a good keeper, while those grown from forty to fifty miles up the river are exceedingly large and handsome, but have poor keeping qualities, being but little more than a fall apple. The Newtown Pippin does well in some localities, while in others it is not a success.

The Yellow Bellflower is extensively grown in this district, and is considered to be one of the strongest growers and most prolific that we have. The fruit is very large and of good quality.

The Baldwin is a profitable apple; it is a late keeper, rather well colored, and bears good crops. The Smith Cider is a strong-growing tree and bears abundant crops; the fruit is well colored, and of medium size on uplands, yet it is exceedingly large and handsome when grown on river bottoms where the soil retains its moisture later. Rawle's Janet is also a variety that is a success; the tree grows strong and bears very heavy crops each year.

The Stark is being planted in large numbers, and promises to be a good apple for this locality; the tree is a strong grower; fruit very good.

The early varieties grown are: Golden Queen, Early Harvest, and Red Astrachan, all of which succeed well throughout this district.

The fall varieties are: Gravenstein, Maiden's Blush, King of Tompkins County, Washington Strawberry, Pennock (or Pomme Roye), and Golden Russet, all of which varieties do well in this district, each in the locality best suited to it.

The winter varieties are: Yellow Bellflower, Rhode Island Greening, Baldwin, Smith's Cider, Stark, Hoover, Vandevere, Virginia Greening, Rawle's Janet, and Ben Davis. These are the leading varieties grown,

but we may have many others that have been planted of late years and have not as yet been fully tested, which I will speak of under the head of new varieties, though most of them are old; yet they are new to this portion of the State, and therefore I will speak of them as new.

Localities.

Along the course of the Smith, Klamath, Trinity, Mad, Van Duzen, and Eel Rivers are grown as handsome and fine flavored apples as can be found on the Pacific Coast. Many varieties of late keepers retain their flavor and keep sound as late as July and August.

New Varieties.

Under this head I will mention, first of all, the Arkansas Pippin, which I think will stand at the head of all the new varieties as the leading apple to be planted in the future for profit. It seems to combine all the qualifications which are required to make a first quality apple for the market.

(1) It is very large and handsome; (2) it is the most beautiful tint of red streak that I have ever seen, coloring on the under side almost as well as on the side exposed to the sun; (3) its rich flavor and good keeping qualities should commend it to any one desiring to procure an apple of the finest quality.

The tree is an early bearer, often bearing fruit the second year after being planted, thus adding another good point to the many already mentioned.

The Lawver is being introduced in this section, and promises well; also the Arkansas Black, New Jersey Black, Early and Late Russian, Russian Emperor, and many others.

The fruit grower will soon be able to select the best apple to be planted in each locality, thus rendering the apple orchards more profitable in the future than they have been in the past. The great drawback to the apple orchards of this section has been that they contained too many varieties which were of no practical value, thus causing great loss to the producer.

Propagation.

The seed of the apple is planted in drills, and grown until one year old; then it is taken up and collar grafted at a point about two inches above where the roots branch out, using the whole of the root of the seedling apple for each scion, thus insuring a good root for every tree.

The grafts are then planted about six or eight inches apart in rows three feet wide, giving ample room for thorough cultivation, where they grow until one or two years old; they are then taken up and planted in orchards.

CRABAPPLE.

The Siberian and most of the other common varieties are grown here, all of which grow strong and produce good crops. Many of the larger varieties produce such heavy crops that it is difficult to keep the branches from breaking when loaded with fruit.

WILD CRABAPPLE.

We have but one variety, which I take to be *Pyrus rivularis* (Oregon crabapple). The tree grows from fifteen feet to forty feet high, often from ten to sixteen inches in diameter; it also grows in the form of a bush in dense thickets. It has sharp-pointed, dry limbs, like thorns, all along the branches and trunk of the small trees, thus rendering it almost impossible to penetrate one of the thickets.

The fruit is orbicular; color, yellow just before it is ripe, and bright red when fully ripe; oblong, half an inch or more in length, and exceedingly tart. It is found throughout the whole of northwestern California. In Humboldt County it is very plentiful, and was used by the early settlers as a stock on which to graft the apple. There are many trees in the county which are now growing on the wild crab root.

PEAR.

The pear grows well in this part of the State, and many varieties are cultivated, but the Bartlett takes the lead as a marketable fruit. It grows large and fine, and always finds a ready sale. The best pears are grown from ten to thirty miles from the coast and along the course of the rivers.

The Winter Nelis is not a success in many parts of this district, on account of its being troubled with fungus, causing the fruit to be small and illy shaped, and in a measure destroying the outer skin; yet there are some localities where it is grown successfully. While Eel River, Mad River, and many other sections of the county produce a fine pear, yet particular attention is called to Camp Grant, South Fork, and Blocksburgs as being particularly adapted to the growth of that fruit. Nowhere in this northwest can be found a locality better suited to the growth and development of the pear than the districts just mentioned.

Among the varieties grown are Bartlett, Clapp's Favorite, Keiffer's Hybrid, P. Barry, Winter Nelis, and others.

The pear is worked on seedling pear stock by budding and grafting, in the same manner that the apple is worked on the apple.

QUINCE.

The quince is but sparingly grown in this district, there being so little profit to the orchardist in growing such fruit; yet this district can, and does, produce quinces of the very first quality. It is a good grower, and produces fruit in abundance.

The varieties grown are as follows: Orange, Pear-shaped, and many others.

The mode of propagation is principally from suckers or slips.

PLUM.

The plum tree, in this portion of the State, finds a climate and soil peculiarly suited to its nature. Its growth is luxuriant, and it produces annually large quantities of excellent fruit. It will grow on any dry land, from the river bottoms to the hilltops, but is best adapted to a good, rich, moderately dry loam.

The chief varieties grown for the market are: Prune d'Agen, Silver, Italian, Hungarian, German, and Coe's Golden Drop.

Prune d'Agen (syn., French prune).—This variety stands at the head of the list as a drying prune in this locality, and when properly tended never fails to reward the husbandman for the labor bestowed upon its cultivation. Its only fault is that it produces too much fruit, and is liable to impair the health and vigor of the tree by such overproduction; this can, however, be remedied by thinning the fruit.

Italian Prune (Fellenberg).—This is also a good drying prune, yet it is not so sweet as the French. The tree produces well, and bears very evenly. The fruit is large and fine, and is very nearly all of the same color; the tree grows strong, with a widespreading head and very rich foliage.

German Prune.—This variety is grown in many localities; it grows well and bears abundantly, but it is not cultivated to any great extent in this district, there being other varieties which are more profitable.

Silver Prune.—A great many of this variety have been sold in Humboldt County, and are now from four to five years old, but the tree has not given entire satisfaction. This may be owing to the stock on which it was worked. The tree bears well and the fruit is large and fine, yet the life of the tree has proved to be short, many dying before they were five years old. As a drying prune the Silver has proved very good; it makes a very attractive fruit and has a rather pleasant flavor.

Hungarian.—The Hungarian prune makes a very strong-growing tree, and the fruit is exceedingly large and fine. In this district it is used principally for fresh fruit and canning, but is not considered a very profitable variety to grow.

Plums of every variety grow to perfection, and are found in nearly every garden and orchard throughout the northwestern portions of the State, and are so plentiful that many varieties have but little market value in our local markets.

Propagation.

The plum is propagated by budding upon plum and peach stock only; the apricot and almond have been discarded on account of their not properly uniting with the plum, and also on account of their not being suited to the different kinds of soil in which they would be planted in this district.

The Myrobolan plum is the only plum stock used, and as an all around stock on which to bud the French and other prunes, it is conceded to be the best, and is adapted to a greater variety of soils than any stock that has yet been tried in this locality. It will stand more wet than any other root that can be found, yet at the same time it will grow well in rather dry soil, thus making it the most valuable stock on which to grow the prune.

The peach root is used in some localities as a stock on which to bud the prune or plum. Many thousand trees in this district are growing on the peach root, and where the soil is suitable for the peach the tree grows well, but if the soil is a heavy, compact clay, the peach root is not a success.

The plum is propagated in the following manner: The pits of the Myrobolan plum or the peach are planted in nursery rows, where they grow for the first year. The following August they are budded at or just

above the ground with the varieties desired, and when the bud has grown one year it is generally from three to six feet high, and is then ready to be taken up and planted in orchards.

CHERRY.

The cherry is grown throughout the whole of northwestern California; it is to be found in the door-yard, garden, and orchard in all the rural districts. It is one of the fruits particularly adapted to this climate; it appears to do equally as well on the hilltops and hillsides as it does on the river bottoms. The growth of the tree is not so strong on the high land, but it bears just as plentifully and produces as fine fruit.

The varieties grown are: Black Tartarian, Black Bigarreau, Yellow Spanish, Royal Ann, Elton, English Morello, Monstrous de Mazel, Early Rivers, Olivet, May Duke, Late Duke, and many others.

The Black Tartarian is considered by many to be the best cherry to grow for profit in this locality; it is a large, smooth, shining black cherry when ripe, very attractive in appearance, and of excellent flavor. It will be unnecessary to mention how the different varieties grow and produce, for almost any variety does well here.

This fruit is grown without irrigation, there being sufficient rainfall during the winter months to keep the ground moist and in good condition during the dry season, thus causing the tree to grow strong and the fruit to fully develop. Cherries grown without irrigation have a much better flavor than those that are watered, therefore this portion of the State has the name of producing the finest flavored cherries to be found in the market.

Cherries are grown from three weeks to a month earlier along the Trinity and South Fork of Eel River than they can be grown in the lower Eel River Valley.

The cherry is propagated by budding on seedlings of the common black Mazzard, and also the Cerasus Mahaleb; for standard trees we are using the former, and for dwarf, the latter.

After the seedlings have been planted in nursery rows, they are generally ready for budding in the following August. The bud is inserted as near the ground as possible, and from it springs a strong, straight shoot, thus insuring a good, smooth trunk for every tree.

PEACH.

This delicious fruit is cultivated in many parts of this district, principally along the course of Mad, Klamath, Trinity, and Eel Rivers. In these localities the peach can be grown with profit, and the fruit produced will compare favorably with that from the most favored fruit districts of the State.

The best peaches are grown several miles from the coast, where sheltered from the northwest wind by trees or intervening hills.

The varieties grown are: Alexander, Briggs' May, Early and Late Crawfords, Early York, Hale's Early, Muir, and others. Mention is only made of the varieties that succeed well here, and those that are principally grown, yet there may be others, when tried, that will do equally as well.

As regards propagation, the seed of the peach is sown in nursery

rows, where they grow for the first year; they are then budded the following August with the variety desired. The bud is always inserted under the bark of the young seedling, at or near the ground, thus insuring a strong, healthy trunk for each tree.

APRICOT.

This fruit is not extensively grown in this part of the State. Its propagation has not been thorougly understood. It has been worked upon its own root, or upon the peach, causing the life of the tree to be short and unsatisfactory, when planted on heavy land.

If the apricot is worked upon plum, I can see no reason why it should not produce good fruit, when planted on the clay loam of this district, whereas now they are only grown on sandy or light soil. There are many localities in this portion of the State where this fruit is grown. Those grown twenty to thirty miles from the coast are large, fine, and highly flavored; yet this fruit has not been tested enough in the different localities to say what its future may be.

NECTARINE.

This fruit is very little cultivated in this district, the principal portion of it being grown along Eel River, twenty or thirty miles from the sea. The few nectarines that come from main Eel River and the South Fork are very fine in appearance, and, no doubt, they can be grown in those localities successfully.

PERSIMMON.

The persimmon has not yet been planted here to any great extent. Few trees have been planted, and those few have been very poorly cared for. A portion of these have done fairly well, and several that are known of have produced fruit of fair size and quality. The persimmon has not been fairly tested here. Various Japanese varieties are grown.

GRAPE.

The grape is not extensively cultivated in this district, and although there are thousands of acres on which it could be grown successfully, yet its culture has been neglected, owing to the lack of transportation facilities. In many localities it has been tested sufficiently to form an idea of what it could do if planted in large vineyards. Along the South Fork of Eel River it succeeds well, and the following varieties are grown: Flame-colored Tokay, Mission, Stillward's Sweetwater, Muscatelle, and Black Hamburg. These varieties mature well, and produce large and handsome bunches of grapes.

The Klamath and Trinity Rivers are also favorable localities for its culture. Grapes grown along these streams are of excellent quality; the vine grows well and is very prolific.

CURRANT.

This little fruit is at home in Northern California. The cherry currant has been grown throughout the Eel River Valley for a great many

years. The bush grows thriftily and bears heavy crops, the fruit being large and fine.

Fay's Prolific is the best variety for planting in the valleys, being a strong grower and a good bearer.

The White York and White Grape are good varieties, and do well in this district. Both are prolific bearers, and the fruit is all that could be desired.

The mode of propagation is very simple: In the fall or spring, take cuttings about a foot long and plant them in moist soil, and they will readily take root. The following season they are ready to plant where the bush is desired to grow.

FIG.

The fig tree thrives here, but does not fruit well near the sea, but in favorable localities, back from the coast, it is grown. The only variety planted has been the common black fig, but if some of the better varieties were planted in favorable localities no doubt the result would be encouraging.

The fig has not been tested sufficiently for the fruit grower to tell what it may do in the future, or what locality would be best adapted to its growth and development.

GOOSEBERRY.

This berrry is a success in this part of the State; it produces well in almost any portion of it. There are many varieties cultivated, but it would not be well to attempt to mention all of them. However, mention will be made of a few of the leading varieties grown.

The large English is grown by many, but in this locality it is liable to mold or mildew, which renders it much less valuable than it otherwise would be.

The large French is a very profitable berry to grow, its greatest diameter being three quarters of an inch or more, and it is thought that it will prove a desirable berry for this vicinity.

The Rochester Seedling and the Industry are two more of the standard gooseberries of this locality, and produce abundant crops.

The gooseberry is propagated by cutting off straight young shoots and planting them in moist soil, five or six inches deep and six or eight inches apart; they are allowed to remain in this position until thoroughly rooted, and are then taken up and planted wherever desired.

STRAWBERRY.

The strawberry is quite extensively grown for the local market, and has proved to be one of the most valuable berries cultivated in this district. Its growth is strong and vigorous, and it produces well. The varieties grown are the Sharpless, Perry, and others.

The Sharpless is an exceedingly large and handsome berry, with rather a pleasant flavor, and is a prolific bearer.

The Perry is also a good berry for this locality, and is considerably grown.

Among the new varieties are the Gaudy and Mammoth. The Gaudy is an excellent berry, and the most prolific of the late varieties. It

fruits well, and is a very good bearer. The Mammoth is one of the best early varieties, the berry being good, and it is a profitable kind to cultivate.

There are many varieties of wild strawberries that are indigenous to this portion of the State. They grow among the wild grasses on the hillsides and in the valleys. They are all very pleasant in flavor, and in that respect many of them surpass the cultivated sorts, yet most of the wild berries are quite small, and only a few of them obtain any considerable size.

The strawberry is propagated from runners or sets that run out from the old plant. These are planted in rows from eighteen inches to three feet apart, the ground between is thoroughly cultivated, and after one year the plant is in full bearing.

BLACKBERRY.

The varieties cultivated are the Kittatinny, Lawton, Wilson's Early, and Erie.

The Kittatinny is a very strong grower and good bearer, the berry being large and of good flavor. The Wilson is the earliest, and is a very fine, soft, sweet berry when ripe, and produces well in this locality.

The Erie is a new variety; very late, ripening in September, and approaching in flavor the wild berry nearer than any of the cultivated varieties. The berries are large and fine.

WILD BLACKBERRY.

This berry is indigenous to this portion of the State. I believe that there can nowhere be found a locality that can excel the Eel River Valley in the production of this wild berry. It grows and bears abundantly from the shores of the Pacific Ocean to an altitude of two thousand feet above the level of the sea.

For canning, preserves, and as a dessert dish, the wild blackberry of Humboldt County stands at the head of the fruits, both wild and cultivated. It has that peculiar tart flavor that can be found in no other fruit, and which renders it so invaluable to every household as a dessert dish.

The blackberry grows long and spreading, the vines from it often exceeding fifteen or twenty feet in one year. The fruit is jet black when ripe, about half an inch in diameter, and from half an inch to an inch and a quarter long, growing in clusters of from three to seven, attached to prickly peduncles by slender, prickly pedicels. It is very prolific, and ripens from the middle of June to the end of July.

RASPBERRY.

The raspberry is cultivated in almost every garden in this vicinity, and never fails to produce a large crop of berries each year. It is so common that it finds but little sale in the local markets.

The varieties grown are Cuthbert, Golden Queen, and others; all succeed well.

The raspberry is propagated by suckers or offsets springing up from the main root; these are divided into single canes or plants, and are

planted in rows from three to four feet apart. The best soil for the raspberry is a rich, deep, moist loam, and yet it does well on hillsides and at considerable elevation.

The black raspberry grows wild over a large portion of Northern California, in the mountains drained by the waters of New and Trinity Rivers, at an elevation of from three to four thousand feet. The berry is of medium size and of very good flavor, and there is no reason why it should not be a good variety to cultivate. It generally grows on rocky ground, and often in the cracks and crevices of rocks that contain some earth and decayed vegetation.

HUCKLEBERRY.

This berry is indigenous to this part of the State. In shape it is globular; the color blue black, and about three lines in diameter, growing on a bush from three to ten feet high.

It has a very pleasant flavor, and is chiefly valued for canning. It is found on the hills along the coast and in the redwood forests of Mendocino, Humboldt, and Del Norte Counties. It is nowhere cultivated in this district.

SALMON BERRY.

The salmon berry (*Rubus spectabilis*) is indigenous to this portion of the State. It is generally found in shady woods, where it grows from five to ten feet high. The stem of the young shoot is green and armed with straight, stout prickles; the bark becomes brown and shelly as the bush grows old. The leaves are trifoliate, the fruit large and ovate; in color, red or yellow.

It is found on the bottom lands of all the rivers and small streams throughout the northwestern part of the State, and also in the redwood forests along the coast.

MULBERRY.

The mulberry tree does well in Northern California. It is a good grower, and the berry is large. It is generally grown as an ornamental tree.

The varieties are the Black English and Everbearing.

NUTS.

English Walnut.

The English walnut tree succeeds well in this district, but bears nuts only in favorable localities. Along upper Eel River the tree bears well; while in the lower Eel River Valley it bears very light, or not at all.

Almond.

The almond tree bears only in favorable localities, although the tree thrives well over most of Northern California.

Black Walnut.

The black walnut of the Eastern States grows luxuriantly, and bears well when sixteen years old. It will grow and produce in almost any part of northwestern California.

Peanut.

The peanut can be cultivated in almost any part of this district where the soil is suitable to its cultivation. It produces well.

Hazelnut.

This nut is native to this portion of the State, and can be found from the valley lands to the mountain tops. It is very productive and hardy, rarely, or ever, failing to produce a good crop annually. The bush is from three to eight feet high, and the nuts generally grow in pairs, sometimes three or four in a cluster, half an inch or more in diameter, incased in a thick, prickly hull, from which they are easily separated when ripe. It is found along the coast, from Mendocino to Oregon.

Chestnut.

A Japanese chestnut sent to J. O. Dinsmore, of the lower Eel River Valley, by the San Francisco "Bulletin," and one or two others, are the only specimens that have come under notice. The tree of Mr. Dinsmore is a decided success. It is five years old, and has borne nuts for two years, and is now full of nuts not yet fully matured. This is probably all that could be asked of the chestnut in any locality. The tree is about twelve feet high, and is strong and healthy.

PARASITES, FERTILIZING, SOUR ORANGE STOCK, FUMIGATING, NEW SCALE INSECT, ETC.

San Francisco, Cal., September 22, 1890.

B. M. Lelong, *Esq.*, *Secretary State Board of Horticulture:*

Dear Sir: As instructed, I visited the San Gabriel District, where the new scale parasite has made its appearance, and carefully investigated its importance to the citrus fruit growers; I also give some notes upon fertilizers, sour orange stock, and fumigation, all of which is herewith submitted.

Very respectfully,

ALEXANDER CRAW.

CITRUS SCALE INSECT.

(*Aspidiotus citrinus*, Coquillett.)

The yellow (previously known as red) scale, found prevalent throughout the San Gabriel Valley, is entirely different from the one found in the Santa Ana Valley; the latter, however, is more destructive and most to be feared. These scales are so nearly alike that the casual observer would take them to be the same insect. In 1880 Mr. B. M. Lelong *first* called public attention to their difference, habits, color, etc.

"There are two scale insects within this State which attack citrus trees. In 1880 Professor Comstock visited this State and carried on a series of experiments upon the red scale in Los Angeles. The scale upon which he conducted his experiments he identified as the *Aspidiotus aurantii* of Maskell, and which is the same scale as that found throughout the Santa Ana Valley and Los Angeles City.

"This scale was introduced into Los Angeles County on some lemon trees imported from Australia, and which were planted at the old Keller homestead, on Alameda Street. It was introduced into the Santa Ana Valley on some orange trees, also imported from Australia, which were planted in the Huntington orchard at Orange. From those trees this scale spread. In San Gabriel a scale insect made its appearance on some trees that were also imported from Australia and planted in the Rose orchard. At that time orange and lemon trees were only imported from Australia.

"My attention was called to this latter scale after it began to make its presence felt. Upon examination I concluded that it was a different insect. In 1880 I communicated these facts to Mr. Alexander Craw, of Los Angeles, a very careful observer, who visited the orchard and fully agreed with me in my conclusions. In 1881 the late Mr. Cooke, then Horticultural Officer, visited Los Angeles, and I took him to San Gabriel; and after careful examination he also pronounced it different.

"It has been said that 'there may be two forms of the same insect.'

If this be true, why are their attacks on the tree so different? Mr. Klee, in his report as Inspector of Fruit Pests (Biennial Reports State Board of Horticulture, 1885–6 and 1887–8), mentions the fact that the two insects are different, but described the one prevalent throughout the Santa Ana Valley and Los Angeles City as an 'Australian type,' and the one prevalent throughout the San Gabriel Valley as a 'Japanese type.' The trees that arrive from Japan are generally infested by this latter species, but previous to 1880 *no* orange trees were ever imported from Japan. The trees upon which both of these scales came were imported direct from Australia, and beyond this we know but little; but all indications point towards Australia as being the home of both these scales.

"In 1880 I had the management of a large orange grove in Orange, where I carried on a series of experiments covering a period of three years. In 1883 I moved to San Gabriel, where I carried on a series of experiments covering a period of two years. I was thus able to notice the difference between the two insects.

"From observations made, I feel satisfied that there are *no* 'two forms,' but that the red scale found throughout the Santa Ana Valley, and the red scale found in the San Gabriel Valley, are two distinct species. Why? First, because the red scale that is found throughout the Santa Ana Valley attacks the limbs, leaves, fruit, and the trunk of the trees. The one at San Gabriel only attacks the leaves and the fruit. Secondly, in the former the limbs die back; in the latter they do not. Thirdly, the color of the scale of the former is vermilion red; the color of the latter, dirty yellow, and much smaller. The young scale of the former, as soon as a covering begins to form over the insect, is also of a vermilion red, while that of the latter does not differ from the color of the mature scale."*

A few weeks ago Prof. D. W. Coquillett made a complete and careful microscopic examination, and found structural differences that place it as a distinct species, and named it *Aspidiotus citrinus*. The question of differences is now a settled fact, and it is indeed pleasing to know that this has been decided, as the very high authority to whom this subject has been referred pronounced them identical, and thus deterred others from carrying on further investigations.

YELLOW SCALE PARASITE.†

(Genus *Coccophagus*, New Sp.)

This minute chalcid fly, of the genus *Coccophagus*, was first discovered preying upon the red scale by Professor Coquillett, in the summer of 1887:

"It is still a question whether these chalcid flies are the true parasites of the scales from which they were bred, since they may have originally preyed upon some of our native species. It is to be hoped, however, that these little parasites will increase to such an extent as will enable them to keep these destructive insects within due limits."‡

After having made a careful and complete investigation I find that

* Special bulletin, "Fruit Culture," June, 1890, by B. M. Lelong.
† Parasitic upon the yellow scale (*Aspidiotus citrinus*, Coquillett).
‡ Professor D. W. Coquillett in "Pacific Fruit Grower," June, 1887.

they have accomplished, to a great extent, what Professor Coquillett then hoped they would.

The yellow scale (*Aspidiotus citrinus*, Coquillett) is no longer a pest in the San Gabriel Valley, no more so than the cottony cushion scale (*Icerya purchasi*, Maskell); the former due to its being checked by this minute parasite, and the latter by the Australian ladybird (*Vedalia cardinalis*). This yellow scale parasite is rapidly spreading. I found it several miles from the orchard where it was originally discovered, traveling eastward as far as Duarte, and westward to Alhambra.

Fruit growers should undertake the colonization of this parasite upon the red scale (*Aspidiotus aurantii*, Maskell), found prevalent throughout the Santa Ana Valley and Los Angeles City.

The most noticeable improvement derived from the work of this parasite was observed in the groves at the Sierra Madre Villa, where, two years ago, the trees presented a sickly and stunted appearance, the foliage sparse and mottled. Now this is all changed, the foliage being deep green and abundant, and these orchards have a good crop of fruit.

Since the Australian ladybird (*Vedalia cardinalis*) has destroyed the cottony cushion scale (*Icerya purchasi*), and the *Coccophagus* has reduced the number of yellow scales throughout the San Gabriel Valley, the orchards present a most thrifty and healthy appearance. This wonderful effect is also noticeable in the very extensive groves of the Messrs. A. B. & A. S. Chapman, Col. J. R. Dobbins, and others. This is very encouraging, as two years ago, on account of the attacks of the "white" and "red" scales upon citrus trees, many growers became so discouraged that after a long and expensive warfare against these pests many acres of citrus trees were dug up and cut into firewood.

As a result of the improved state of affairs, orange planting has had a veritable boom this season, the local supply of trees not being sufficient to supply the demand, and most of the nursery stock is engaged for next season's planting.

NOTES UPON FERTILIZERS.

The rich and productive soils of California have been favorably commented upon by Eastern and European agricultural and horticultural writers, and until recently the fruit growers of the State have considered it a useless expenditure of money and loss of time to even apply to the soil the manure that has been produced upon the farm; but upon the trees reaching maturity and producing carloads of luscious fruit, it became evident that something had to be done to replace all this drain of plant food. Several orchardists have been experimenting in this line with most gratifying results. A prominent orange grower of Riverside remarked: "I would mortgage my property to purchase fertilizers;" and judging from the results and experience of other growers, if a reliable fertilizer is used judiciously, the risk of foreclosure would be very small.

Commercial fertilizers have been used with stable or sheep manure. One grower was of the opinion that he would have had better results had the same amount been expended in sheep manure. However, we have to experiment in this line, as the demand will soon exceed the supply, and more particulary so as sheep manure now costs, delivered at the railroad depot at Riverside, 6 cents per cubic foot.

One of the first orange growers (in Riverside) to see the advantage of manures was Mr. Geo. Crawford, on Magnolia Avenue. A portion (one acre and a half) of his grove has been annually fertilized for six years with a heavy covering of stable manure applied broadcast in winter. The soil from this fertilizing would be, by florists, considered good potting compost. The natural soil in the immediate neighborhood is a sandy loam, thirteen feet deep, and from appearances would be considered rich enough to last a quarter of a century. The trees are seedlings, have been planted fifteen years, and are twenty-four by twenty-eight feet apart. The deep green foliage, vigorous growth, and very heavy crop, demonstrate the truth of the old saying: "Feed the tree and it will feed you." One remarkable feature, and one worthy of note, is the fact that this part of the grove has had an annual increase in crop of 50 per cent, without the mortifying light crop every second season (a peculiarity of seedling orange trees). Mr. Crawford intends pursuing this treatment with this part of his orchard. The other portion he has fertilized with stable and sheep manure, and last season he gave it a dressing of one ton per acre of bone meal, at a cost of $37 per ton. These trees are also in fine condition.

Mr. W. P. Lett, of Riverside, had good results from Mexican guano, one ton per acre applied two years ago at a cost of $36 per ton. His crop is good and the trees healthy. For five years previous he used stable and sheep manure. Mr. P. Klinefelter, of Riverside, is the owner of a thirty-acre grove; soil heavy loam, eleven feet deep. He gave his place a dressing of twenty thousand pounds of Mexican guano. At the time of this dressing some of the trees were showing yellow foliage, and after applying the fertilizers the trees changed to deep green.

Mr. C. G. Hurd has used Mexican guano upon his place for two years. His trees look well and have a good crop; but he believes he would have had better results from the same amount of money, $47 50 per acre, expended in sheep or stable manure.

Mr. Geo. H. Fullerton and Mr. B. B. Barney both report great improvement in trees and crop from a liberal application of Mexican guano. Mr. D. H. Burnham, of Riverside, reports that four years ago his lemon trees were cut back, and the following season he dressed with half a ton per acre of Haas' fertilizer, at a cost of $19 per acre; before its use his trees looked yellow; now they are a deep green. The two following years he used the same amount. He believes that his trees have been much benefited by it, yet others using this fertilizer have not had such good results; so he is not inclined to give it his unqualified approval.

The question is, Would the results have been as satisfactory if double the quantity had been used? as it is not a fair test to compare $19 worth with $35 or $40 worth of sheep or other manure. A portion of his vineyard that he considered necessary to fertilize in order to bring it up to the condition of the balance, he dressed with half a ton of Haas' fertilizer per acre, and had double the amount of grapes and larger berries than from the other portion not fertilized. The orchards of Messrs. A. B. & A. S. Chapman, of San Gabriel, two years ago were very seriously infested with white scale (*Icerya purchasi*). Mr. Chapman adhered firmly to the belief that the trees could be made to throw off considerable of the scales, or be in better condition to resist their attacks, if the proper fertilizers be applied. In 1887 the orchard was irrigated by the basin system, and lime and sheep manure added to the water, which

then became liquid manure. He also applied in the fall of 1888 one ton per acre of superphosphate, at a cost of $25 per ton; and in 1889 he applied to thirty acres of the orchard nine tons of sulphate of ammonia in two dressings—one in July the other in August. The trees very soon changed from yellow to dark green, and have made a good growth.

Two seasons ago the orchard only produced six hundred boxes of fruit; this year's crop is estimated by Mr. Chapman at ten thousand boxes. I am satisfied from the appearance of the trees and the advanced condition of the fruit that he has underestimated his crop. The soil is a light sandy loam.

Bone meal is one of the most valuable and durable fertilizers, and will be extensively used the coming winter by the orange growers.

SOUR ORANGE STOCK.

In the limited time at my disposal it has been impossible to make a thorough investigation of "sour orange" as to its adaptability for a stock in California.

I visited the orchard planted by D. C. Hayward, at Orange, and found it subdivided into city lots, and owned by parties that could give no information about the trees that surround their houses.

Mr. C. H. Young, who was foreman for Hayward from 1877 until 1883, is positive that no trees were planted in that grove in orchard form upon sour orange stock. But in 1882 Mr. Hayward obtained from Florida one hundred pounds of "sour orange" seed. This was planted in seed beds, and the seedlings afterwards transplanted in nursery rows. The trees were budded and sold.

I also visited the Bliss orchard in Riverside, and saw twelve orange trees eleven years old, said to be budded upon sour stock. If this is a fact, they compare favorably with trees of thirteen years' growth. The soil is mesa, or upland, sandy loam, like the southern portion of Riverside, and requires irrigation in summer. The property has changed hands, but I am informed that Mr. Bliss received the small "sour" seedlings from Florida, and afterwards budded them. Younger trees that I have examined in nursery and orchard, after the first season appear to adapt themselves to the climate and soil and make fine trees.

FUMIGATION.

Fumigation by hydrocyanic acid gas for the destruction of red scale (*Aspidiotus aurantii*), in the Santa Ana Valley, is now carried on with most gratifying results, both in regard to killing the scales and the effect upon the trees. The orchards visited that had been treated were in splendid condition, and after careful examination of the trees I was unable to find any live scales.

The Navel orange grove of Mr. Charles L. Leslie, of Orange, in July last was very seriously infested with red scale, and had all the appearances of having been scorched by fire. In August he treated them with gas, and the trees, in less than two months, have made over one foot of growth, and have very little appearance of having been almost defoliated. The trees are ten feet high and six to eight feet through the branches.

In the preparation of the gas he used two and one fourth ounces of C. P. cyanide of potassium, two and one fourth ounces of sulphuric acid, and three ounces of water. He put the ingredients into an earthenware vessel and allowed the tent to remain over the tree for forty minutes; and with four tents two men treated from fifty-five to sixty trees per night.

Mr. H. Hamilton and Mr. Frank Collins have also had good results from the use of this gas in their groves.

The treating of fruit trees in their growing period, especially the peach, is of course difficult with almost any remedy. There is no doubt but that this gas treatment will be effective on fruit trees for the destruction of the San José scale (so called), as well as it has been on citrus trees; therefore it should be experimented with; but before it is used on a large scale, the results should prove that it does not injure the tree or foliage.

From the success that Prof. D. W. Coquillett and I had in our experiments with this gas in the fall of 1886, I would advise the use of it for the destruction of the pernicious scale (*Aspidiotus perniciosus*, Comstock), for where properly applied and a good quality of cyanide is used, no scale can escape its deadly fumes. The expense will be greater for the first treatment, but the effect will be more lasting, and as it will not be necessary to repeat the operation for two or perhaps three years, the saving in labor will be quite an item.

FRUIT CULTURE IN FOREIGN COUNTRIES.

The Department of State at Washington, D. C., on September 28, 1889, at our request issued a circular letter of instructions to the consular officers of the United States, requesting them to furnish us with such information in response thereto as could be acquired upon the cultivation, preparation, etc., of the fruits grown in their districts, especially the olive, the orange, the lemon, and the fig. The consular officers have filed with the department elaborate and exhaustive reports, from which the following extracts are herewith appended, through the kindness of the Chief of Bureau of Statistics, Mr. Michael Scanlan.

FIG CULTURE.

VENEZUELA.

LAGUAYRA.

The fig is rarely met with here, although the soil and climate seem well adapted to its culture. One may occasionally see a fig tree, planted, it would seem, more for ornament or shade than for its fruit, notwithstanding the fact that the tree yields two or three crops per year.

WINFIELD S. BIRD,
Consul, Laguayra.

WEST INDIES.

BERMUDA.

REPORT BY CONSUL BECKWITH, OF HAMILTON.

Figs are grown on the island, but the same insect which has destroyed all the peaches has attacked the figs, also the guavas, so in a short time these fruits, like the peach, will be a dead letter, for scarcely anything is done to destroy the insect, and as we have no winter they increase the whole year, the fruit falling on the ground and being allowed to rot there. At one time olive plants were imported here by the country, but no care was given them. They have since dwindled away, only a few trees here and there remaining, but the fruit is put to no use. A little more energy and enterprise are needed in the island to advance various branches of agriculture and fruit culture, which at present bring no profit.

HENRY W. BECKWITH,
Consul, Hamilton.

TRINIDAD.

J. H. HART, GOVERNMENT BOTANIST, TO CONSUL SAWYER.

Only here and there a plant exists which ripens fruit fairly, but the produce is carried off when nearly mature by the frugivorous bats.

CUBA.

REPORT BY CONSUL-GENERAL WILLIAMS, OF HAVANA.

Figs grow here, but their cultivation is limited to private gardens. The trees do not obtain the size observed in the gardens of Norfolk, Va., Charleston, S. C., Savannah, Ga., or New Orleans, La. Neither does the fruit seem to be equal in flavor to that grown in those places. It is rarely ever seen for sale in the market houses fresh from the trees. Dried figs in considerable quantities are imported from Malaga, Spain, where great attention is given to their cultivation.

RAMON O. WILLIAMS,
Consul-General, Havana.

GUADELOUPE.

The few fig trees found on the island are always sickly and covered with aphis, or lice, and ants.

FELIX ELARDEAN,
Director at Botanical Garden at Basse-terre, to Consul Bartlett.

CONTINENT OF ASIA.

ASIA MINOR.

REPORT OF CONSUL EMMETT, OF SMYRNA.

There are several climatic influences which cannot be foreseen or guarded against, and yet have great effect upon the success of the crop; as, for instance, a greater rainfall than the average tends to darken the fruit when ripe; a high wind blowing for several days from the north while the fruit is maturing has the tendency to make the stems wither and fruit fall prematurely, etc.

There are as many uncertainties and surmises about the fig crop of Smyrna before gathering, as there are in reference to the peach crop in the United States.

As regards the cuttings which the honorable Secretary suggests my obtaining, I beg to say that I am informed that it is too late this season to take the same with any chance of their growing when they arrive in the United States.

Some provision for defraying the expenses, and further directions as to quantity and to whom to be sent, would be requisite before making a shipment of cuttings.

A box of figs grown and packed in California reached here this autumn, and was inspected and universally praised by many dealers. In some instances it was impossible to persuade the parties that said figs were

grown outside of the Aidin District; in fact, some went so far as to designate the orchard. Those who grasped the full importance of this American enterprise predicted that Turkey's supremacy in the fig trade was waning. Some console themselves with the opinion that the American fig will not continue to be good—as the trees (grown from Smyrna cuttings) grow older the fruit will have thick skins and become tough; in fact, become native American figs.

This deterioration of the fruit is very common here, and has been well known for a long time. The transplanting of trees from their own orchard, even for a short distance, makes them give fruit of entirely a different flavor and nature.

It has been suggested to me that if some grower will grow seedlings from the fruit of young trees grown from Smyrna cuttings, the chances of American fig growers will be greatly enhanced, and, perhaps, in time eclipse one of the staple articles of this country.

Varieties.—The best variety for drying and packing is known under the name of Lop. There are two kinds of figs for table use when ripe, but which will not bear drying and packing, viz.: "Zardajik" and "Cheker Inzir."

Situation.—The trees that produce the varieties above named are grown in the Aidin District.

Distance from sea, thirty to one hundred miles; elevation above sea level, two hundred and fifty to five hundred feet. Much exposure to sun is required.

The trees thrive in all descriptions of land, provided they should be protected against the north wind.

Soil.—Rich black vegetable mold is best.

Climatic Influences.—A temperate climate is the main thing; the thermometer should never fall below the freezing point during winter; frost during spring kills the trees.

Temperature.—Minimum, 40 degrees; maximum, 110 degrees; average, 80 degrees Fahrenheit.

Rainfall.—Yearly average, twenty-four inches. Rain during winter strengthens the trees; during summer it injures the crop.

Irrigation.—Good fig orchards are never irrigated; newly planted young trees need watering during the first two years of their growth.

Cultivation.—Fig orchards are plowed four or five times a year, beginning from November.

Fertilizers.—Manure is made use of when the soil is poor.

Pruning.—When the trees grow old, they need pruning during winter.

Picking and Curing.—When perfectly ripe the fruit falls by itself. If not quite dry, it is spread in the sun. There is no fixed time for picking, as the fruit when ripe falls. The fruit is gathered from the ground, and put in black hair bags; it is then loaded on camels, and carried to the nearest railroad station, put in the freight cars, and conveyed to Smyrna; loaded again on camels, it finds its way to the fig market, whence it is sent to the packing houses to undergo the final process of sorting, shaping (flattening out or squaring), and putting in boxes or bags, and is then fit for shipment abroad. No chemical solution is employed; the packers wet their hands with plain sea water, which hastens considerably the sugaring of the figs.

Planting and Propagating.—Distance planted apart, twenty-five feet. The trees propagated by cuttings. There are small and large orchards.

Maturity.—The trees remain fruitful from eighty to one hundred years, and even longer.

Insect Pests.—A kind of bug, known under the name "Basra," is very injurious to the fruit, which it covers with dark yellow and black spots. No one knows how to free the trees and fruit of this pest. The only beneficial insect is the one which comes out of the male fruit, and impregnates the female figs, and the ants which feed on the bug, called "Basra."

W. C. EMMETT,
Consul, Smyrna.

PALESTINE.

REPORT BY CONSUL GILLMAN, OF JERUSALEM.

Varieties.—There is no exportation of the figs grown in Palestine, and scarcely any care is given to the cultivation of the trees. There are said to be as many as twelve varieties of the fig in this country, and, with few exceptions, they are all good for eating. The best known and most easily distinguished varieties are as follows: (1) The large green fig, early in fruiting, known as Dafouri; (2) Small green, later fig, called Ghoudri (greenish); (3) Large purple fig named Gharroubi (carob, from its resemblance to the color of the pod of the carob); (4) Small purple fig, named also Gharroubi; (5) Yellow fig, white inside, known as Biadi (white); (6) Yellow fig, crimson inside, called Karawi (crimson), resembling the Smyrna fig of commerce; (7) Black fig named Swadi (black).

While, as already mentioned, all these are good for eating in the fresh state, Nos. 1, 2, 3, 5, and 6 are the best for this purpose. Equally, though, all the varieties are used for drying. Nos. 5, 6, and 7 are most suitable for the purpose.

Situation.—The trees flourish all over Palestine, from the seacoast up into the hill country, at an elevation of three thousand feet or more. They generally have a full exposure to the sun, but seem to do well in all situations. They frequently attain an enormous size, even on the most rocky hillsides; and whether the land is hilly, rolling, or level, appears to make no great difference to them. The soil is generally clay, or sand and clay mixed, with clay subsoil.

Climate.—At Jaffa, and on the plains, the minimum temperature is 32 degrees Fahrenheit, the maximum reaching 107 degrees Fahrenheit; the average temperature in the daytime being about 70½ degrees, and at night, 55½ degrees Fahrenheit. In the mountains it is considerably colder; though, in general, there are only a few days in January in which it freezes. At Jerusalem the average annual rainfall amounts to twenty-five inches. The growth of the trees and fruit is favorably affected by abundant rains.

Irrigation.—The trees do not require irrigation, and, except when growing in orange groves, are never watered. With systematic irrigation and cultivation, such as received by the orange groves at Jaffa, the fruit is improved.

Cultivation.—As already mentioned, but little cultivation is bestowed on the trees. At most they receive a spring and autumn plowing.

Fertilizers.—Fertilizers are seldom used except when in connection with the orange or lemon trees; and the kind preferred is generally horse manure, or the dung of the mule or camel.

Pruning.—Pruning is not practiced with any system, nor to any appreciable extent. It is considered best to spare the lower branches, and when cuttings for propagation are made they are taken from above.

Picking and Curing.—The fruit is picked when fully ripe. For eating, the morning is deemed the best time of day for picking; but there is little choice observed in the matter. In general, the fig of this country is of inferior size, doubtless in consequence of being given such little attention, and being only used for home consumption. The fruit is dried by being spread in the sun, usually on the roofs of houses, or sometimes on the ground. When partially dried the fig is pressed flat in the hands. Subsequently the nearly dried fruit is strung on strings; and it is often sold in this shape or when placed in sacks.

Planting and Propagating.—The distance at which the trees are planted apart varies from six to ten, or even twenty feet.

Though the fig can be grown from seed, the usual method of propagation is by cuttings, or rather branches slipped off the parent tree.

The size of the orchards is in general not large, though sometimes consisting of several acres. There are only a few hundred fig trees dispersed over the vineyards and gardens at Jaffa; but at Bethlehem, Hebron, and around Jerusalem, orchards of fair size devoted to the fig may be found.

Maturity.—The tree here attains to the age of one hundred years, and with proper care and culture continues fruitful to the last. If neglected too much, it ceases to be productive; though on attention being renewed, it again responds with crops. The trees begin to bear at the third year, and are in full bearing when five years of age.

Insect Pests.—But little has been observed as to insect pests, beneficial insects, or the parasites of the injurious ones. The fig seems to be unusually free from such. A fig is occasionally found containing a worm, which appears to be the larva of one of the smaller moths; but the species has not been determined.

Cuttings.—The rooted cutting or the young tree would be, in all probability, the best method of procuring desirable varieties. I understand that many thousands of young trees have been successfully transported from Smyrna to California, giving full satisfaction.

HENRY GILLMAN,
Consul, Jerusalem.

SYRIA.

BEIRUT AND VICINITY.*

FIRST REPORT BY CONSUL BISSINGER.

Varieties.—The best fig for drying is the green variety. The best variety for eating when ripe is the red variety with elongated stem, called "Bookraty." Also a rounder red variety called "Seedany." Other varieties worthy of culture and for profit are the black variety, and one which ripens in the fall.

Situation.—The trees that produce the varieties above named are grown on plains and on the hills, and from the shore to a distance of twenty-five miles inland to an elevation of two thousand five hundred

* The several reports for Syria were forwarded by Consul Bissinger, being prepared from statistics supplied by parties in the several districts reported.

feet. Constant exposure to the sun is needed. Hilly and rolling lands with white clayey soil are the best.

Irrigation.—No irrigation needed.

Cultivation.—Plow the land in the spring.

Fertilizers.—None put about trees, as it is injurious.

Pruning.—Pruning is not practiced.

Picking and Curing.—The figs are picked when fully ripe in the early morning. Little curing is done in this country; simply dried in the sun, either whole or split; no solution used.

Planting and Propagating.—Distance planted apart, about twenty to twenty-five feet; propagated by slips. The orchards are small.

Trees attain an age of from fifty to sixty years, and are fruitful from four years till they decay.

Insects and worms are treated simply by covering the trunk of the tree with a coating of bitumen.

Slips can be put into earth and conveyed from place to place.

I cannot secure any printed matter, such as reports, methods, or statistics issued by the Government or otherwise; none issued.

SECOND REPORT.

Rain.—Moderate rainfall; about thirty to forty inches on an average yearly. The abundance of rain is beneficial to old trees as well as to the fruit. October and November rains benefit the trees, and March and April rains benefit the fruit.

Irrigation.—Irrigation is only necessary the first and second years after planting. In light soil, watering is necessary twenty days after the rains are over, and in heavy soil one month thereafter.

Cultivation.—Plowing is necessary once or twice after the first rains in November, and is then to be discontinued until the first of February, after which it is to be repeated four times, or every fortnight, after the rains. As soon as the fruits appear, no more plowing is necessary.

Fertilizers.—The fertilizing substances are: A donkey load of sand around each tree once a year, about the early part of December, if the soil is red, and a small quantity of cows' or other manure if the soil is white (*i. e.*, clayey). This treatment increases the growth of the trees and the quantity of the fruit.

Pruning.—Pruning is effected at the end of January by removing the weak and dead branches. To prune the low branches of fig trees increases their growth and production.

Picking.—Gathering, or picking, takes place when the fruit is fully ripe. When for sale, it is effected either in the evening or before sunrise; and if for drying, it must be after sunrise, so as to be dry from dew, which would spoil the color of dried figs.

Curing.—After the figs are gathered, they are split open in the morning and placed in an exposed position to the sun for three days, until they contract and assume a red or yellowish tint. They are then gathered from the drying floor, and after being fully flattened out, are spread in equal layers in a basket until completely filled up. A heavy weight is then placed on the top of the basket. As to figs dried in a heap, they should be gathered when perfectly dry (in other words, when withered on the tree), and spread as they are on the drying floor for four or five days, at the expiration of which they are picked up and pressed flat

between the fingers. This species of dried figs may also be placed in hot water for ten minutes, then left to dry well in the air before packing up in boxes. This bathing process imparts a good color to the figs and preserves them from worms. Dried figs are never placed in any solution.

Plants and Propagation.—The distance between each tree should be at least nine feet. The larger the distance the better the trees grow.

Fig trees are propagated either by suckers or shoots (which grow at the foot of the mother tree), or by slips from the trees.

(1) The way of transplanting by suckers is to dig a hole in the ground about fifteen to twenty inches in diameter and depth in which to place the same, after which the soil is to be so arranged as to be on a level with the surrounding ground, or even a little lower, to retain the water. Watering is necessary just after planting. Some people resort to the practice of putting in the hole of the newly planted sucker a handful of barley to serve as nourishment for the roots. A sucker planted with barley never fails to take root and to thrive.

(2) To propagate by slips it is necessary that a hole be dug in the ground having an average length of twenty-seven inches by thirteen in depth. In this hole the slip, which should be about twenty-seven inches long, is placed obliquely, so as to leave about two inches of it above the ground. The planting of suckers must take place between the first of December and the end of January, and the planting of slips should begin with February and end with March. Water is needed, as stated in answer 6, for the lands that had not been previously tilled and sown. As to the rich lands which had been plowed, they should be irrigated once a month, or once every forty-five days.

There are some large and some small fig orchards, but generally their size is limited.

Fig trees live from five to thirty years, some even longer, and produce fruit until they die off.

The insects are worms produced by excess of water and manure and want of proper pruning. The way to treat them is to put only a little manure or none at all, to prune the trees well, and to make a passage for the water, so as not to allow it to gather around the trees. Birds also attack fig trees, such as the sparrow and the becafico. A scare-crow is most always successful in frightening away these birds.

THIRD REPORT.

Varieties.—The best variety for drying is the Abyad, white inside, green outside; and for eating when ripe, the Bookraty, red inside, green outside. The Asfoory and Bookraty are also cultivated. The Smyrna District is the principal one, Syria coming next, in which fig trees are grown.

Situation.—No matter where fig trees are planted, moderate altitude is the best. Fig trees are benefited by being exposed to the sun.

Soil.—The white clayey soil is preferable. It should be manured once every three years.

Climate.—Minimum, 40 degrees Fahrenheit; maximum, 90 degrees Fahrenheit; average, 65 degrees Fahrenheit. The more abundant the rains the better the trees and fruits prosper.

Irrigation.—Fig trees need no irrigation.

Cultivation.—After the soil gets dry it should be plowed three times during springtime.

Fertilizers.—The soil should be manured once every three years, and plowed as stated above.

Pruning.—After the fruits have been gathered, the dead branches only are cut away.

Picking and Curing.—When the fruit is ripe the morning is the best time for picking. If they are to be transported from place to place, figs must be gathered before they are fully ripe and placed in boxes, but cannot be sent to any distant place. When figs are to be dried, they must be gathered when fully ripe, then spread on a lofty spot for from ten to fifteen days and nights. In this way they can be preserved in boxes during the whole year.

Planting and Propagating.—The trees are planted about thirteen feet, and propagated by slips. The orchards are generally small.

Maturity.—Fig trees attain thirty to forty years of age, and produce fruit from the fourth or fifth year.

Insect Pests.—There are some insects which infest the soil and invade the trunk of the tree, and sometimes cause them to decay, but they do not injure the fruit. Trees so attacked are treated by introducing an iron wire into the affected holes until the insect is reached and destroyed.

Slips.—Slips are to be secured in March.

No printed matter, reports, or statistics exist or are issued by the Government.

SIDON.

Varieties.—The "green" varieties for drying are the Bookraty and Abiad, for eating when ripe. Other varieties cultivated are the black and one which ripens in the fall.

Situation.—Both in plains and hills; best kinds within thirty miles of coast; best growth from five hundred to two thousand feet above sea level; constant exposure to the sun; hilly lands the best; clayey and chalky soil the best.

Climate.—Thirty degrees Fahrenheit to 90 degrees Fahrenheit; rainfall about thirty inches, on an average, annually; an abundance of rain is beneficial.

Irrigation.—Never irrigated at all.

Cultivation.—Spring plowing.

Fertilizers.—None applied. Figs become wormy in rich earth.

Pruning.—Dead branches only are removed.

Picking.—When ripe, and in the morning.

Curing.—Dried in sun only. No solution of any kind used.

Planting and Propagating.—The trees are thirty-two to thirty-five feet apart; propagated by slips; the orchards are generally small.

Maturity—The trees attain to about fifty years, and bear from four years till they die.

Insect Pests.—Principally worms. The remedy is to cover the trunk of the tree with a coating of bitumen.

Cuttings.—Cuttings are secured either by suckers which grow at the foot of tree, or cuttings from the tree itself.

TRIPOLI.

Varieties.—The best variety for drying is the Bayadi (white inside); the best variety for eating is the Bookraty; the other varieties known in this country are the Bookraty, the Bayadi, the Asfoory, the Aswad, the Hammary, and the Shataway.

Situation.—Fig trees grow in the plains as well as in the mountains; the more they are exposed to the sun the better they prosper; they are found in rolling and level land, which is alike adapted for their growth. It is customary in this country to plant fig trees in either white clayey soil or in a blackish soil (the latter not being good for other kinds of trees). In red soil the fig trees grow still better, but the taste of the fruit is less delicious than if grown in a white or blackish soil.

Climate.—Temperature varies from 30 degrees Fahrenheit to 90 degrees Fahrenheit; average, 60 degrees Fahrenheit; rainfall averages twenty-six to forty inches per annum, according to locality.

Irrigation.—Most of the fig trees in this country are found on non-irrigated lands. The fruit of irrigated fig trees is affected by worms and liable to rot.

Cultivation.—Lands upon which fig trees are planted should be plowed three times in the spring.

Fertilizers.—Manure is the fertilizer known, but it is not used for fig trees, for the reason that it causes the fruit to be invaded by worms and to rot.

Pruning.—Dead branches only need to be removed.

Picking.—Figs for drying are picked when fully ripe any time in the course of a sunny day, so as to be well dried by the rays of the sun, and thus prevent their contracting a sour taste.

Curing.—Figs, after being gathered, are spread in the sun for from ten to fifteen days. When they become dry they are placed in a basket and plunged for two minutes in a large copper kettle full of boiling water, in which a small quantity of the fennel plant has been deposited, to impart a nice aroma to the figs. After this process of "bathing," the figs are dried again, and then stored away. Figs are gathered and dried as they ripen, during August, September, and October.

Planting and Propagating.—Distance planted apart, twelve to fifteen feet, according to the quality of the soil. Fig trees are propagated by cuttings from the branch of a large tree having three or four sprays, which is to be placed in a hole dug for the purpose, then covered with earth, allowing one of the sprays only to project, at a height of about two inches above ground. This should take place in the spring, *i. e.*, from the beginning of March to the end of April. Orchards are generally small.

Maturity.—The age of fig trees depends on the quality of the soil and the care bestowed upon them. If good care is taken of a fig tree it lives up to one hundred years.

Disease.—The branches of fig trees are sometimes liable to a disease that manifests itself in the shape of slight swellings, called snails. The remedy adopted is to make small cuts in the tree, which causes the disease to subside.

Cuttings.—No plantations of young fig trees exist in this country. The way to plant fig trees is to secure cuttings from large trees and plant them as stated above.

ERHARD BISSINGER,
Consul, Beirut.

INDIA.

REPORT PREPARED FOR VICE-CONSUL BODE, OF BOMBAY, BY MR. G. MARSHALL WOODROW, LECTURER ON BOTANY AND AGRICULTURE AT THE COLLEGE OF SCIENCE, POONAH.

Varieties.—Figs are not dried in India to any considerable extent, as the local consumption absorbs the supply. The retail price of ripe figs is about 2 annas per pound (say 6 cents) at Poonah, within fourteen miles of extensive gardens. Varieties of figs are not named in India except with the name of the village they are grown at, and such a name is not distinctive. The variety grown in the Deccan is inverted conical, green at the stalk, and gradually deepening to brown at the broad end. Good examples weigh one seventh of a pound.

Situation.—The village of Khed Shivapoor is an important center of fig culture. It stands fourteen miles south of Poonah, which city lies in north latitude 18° 28′ east, longitude 74° 10′. The altitude of Khed Shivapoor is about two thousand two hundred feet above mean sea level, but the fig thrives at Baroda as low as one hundred feet above the sea level. The orchards are fully exposed to the sun. The land of the orchards is nearly level, but they are situated on the slope of a range of hills three thousand five hundred feet in altitude, at a height of two thousand two hundred feet, and about fifty miles from the sea.

Soil and Subsoil.—The soil is calcareous loam; the subsoil, at a depth of about two feet, marl (a mixture of lime and clay), overlying disintegrated trap.

Temperature.—Average, about 75 degrees; minimum, 48 degrees; maximum, 95 degrees. The village is shut in on the northeast and west by hills, which keep out hot winds.

Rainfall is about fifty inches annually, falling chiefly from June till October. The setting in of rain makes the trees ripen the young growth that was made during April and May in the hottest and driest season, and determines the ripening of fruit.

Irrigation.—Irrigation is effected from wells, about twenty-five feet in depth, by a leathern bucket drawn up by oxen at a cost of 10 P. (say 2.5 cents) per one thousand gallons. Two inches of water on the surface of the orchard, per month, from the end of October till the fruit is ripe; the low quantity of water given keeps the fruit sweet. One inch of water is given twice monthly.

Cultivation.—Cultivation consists of plowing or hoeing once yearly after the fruit is gathered.

Fertilizers.—Fifty pounds per tree of well decayed village sweepings are applied at the end of the dry season, in May, after the crop is gathered.

Pruning.—After the young tree has been made to send up five to seven shoots from near the base by stopping the first strong shoots sent out by the cutting, little, if any, real pruning is given. Weak, decayed, or broken branches are cut out to the base, and such as have gone too high for a man's hand to reach are stopped, and if branches are plentiful, cut out, when all the fruit is gathered from them, but the less pruning that is necessary the better. In a few instances the trees are grown as standards; a straight stem is led up about six feet, and from the top of this branches are encouraged to spread horizontally.

Picking.—The pioking is done when the fruit is full grown and shows a slight yellowing at the stalk. Early in the morning is preferred, because fruit picked at that time and kept in the shade retains a delicious coolness. For local use each fig is wrapped in a leaf when it has attained this stage, to protect it from birds, and left on the tree a week longer. This improves the quality greatly, but prohibits carriage to a a distance. No boxing or curing is done in India. The skin of the variety grown is much too delicate, and I have not been successful with European varieties.

Planting and Propagating.—Propagation is effected by cuttings of one-year old wood planted in a moist, shady place during February. The trees are set out ten to twelve feet apart.

Size of Orchards.—The orchards are two to three acres in extent only, because the position on the slope of a hill does not afford larger spaces sufficiently level, and a well rarely waters more.

Maturity.—The trees attain fifteen years, and are fruitful about twelve years.

Insect Pests.—Red spider (*Tetranychus telarius*), or some nearly allied insect, is a serious enemy. No futile attempts are made against it by the cultivators. They think sacrifices to idols effectual. Much yet remains to be done in the entomology of the fig.

Cuttings.—I have never sent cuttings as far as America, but I think that if cut in February, packed in moist sand in a tin box and sent by post, a few would survive the journey. Whether it would be profitable is doubtful, as I am of opinion the fig of the Deccan is synonymous with Brown Turkey, which you probably have in cultivation. I will be glad to send you cuttings if wanted.

Publications.—The Government of India does not issue statistics regarding figs.

G. MARSHALL WOODROW,
Poonah.

AUSTRALASIA.

REPORT BY CONSUL GRIFFIN, OF SYDNEY.

The fig is not cultivated to any great extent in the Australian colonies. The tree will grow and bear excellent fruit all over the country, but its cultivation cannot be called an industry in any part of Australasia. Figs are not dried or prepared in any way for export. There are growers who have experimented with drying figs, but I have never heard of locally dried figs being offered for sale. The figs that find their way to the Sydney market are in a green state. Baron Fred. von Mueller, Government botanist for Victoria, in his work entitled "Select Extra-Tropical Plants," strongly urges the extensive planting of the fig through favorable portions of desert waste for shade and fruit, and in warm districts where the fruit could be dried with particular ease. He directs attention to the ease with which small cuttings of the fig tree were sent by horse post in the early history of these colonies from Port Phillip (Melbourne) to the Central Australian mission stations, a distance as far as from St. Petersburg to the Black Sea, or from San Francisco to the upper Missouri. Baron von Mueller mentions two main varieties which have been successfully introduced into Australia. One includes the purple, white, and golden fig trees, pro-

ducing two crops a year, but are not suitable for drying. The other main variety embraces the Marseillaise, Bellonne, Barnisote, and the Aubique. These produce but one crop a year, and supply the greatest quantity of figs for drying. The Marseillaise and Bellonne are usually regarded as the best varieties. The Barnisote and Aubique are dried with fire heat and are usually consumed fresh. The ordinary drying is effected usually by the sun. Mr. Angus McKay gives the Black Province and Black Italian as the best varieties for drying in Australia, but says very little drying is done here.

The White and Yellow Ischia are favorite varieties. Then there are the Morocco, and the White and Brown Turkey. Different names are given to the same variety of figs, and as no systematic attempt has been made to classify them, there is some confusion in the nomenclature, and it is almost impossible to say which is the best. The fig grows on the sea-coast, and also many miles inland. It has been found to do fairly well at an elevation of two thousand five hundred feet above the level of the sea. Excellent figs are, I am informed, grown in the Forbes and Parkes Districts of New South Wales, but the finest figs I have seen were grown at Tumut, also in this colony, where the soil is of a dark rich loam to a depth of about ten feet. Figs also grow at Port Stephen, where the average annual rainfall is about sixty-two inches. Mr. Angus McKay says the fig thrives best in hilly country, and as to soil, it seems that they do very well in poor sandy soil; where the temperature is 100 degrees figs are produced, and where it is not less than 20 degrees above zero. When the rainfall is not less than twelve inches, or more than thirty inches, they appear to succeed best. When the rainfall is heavy, the trees run to wood. When cultivated here both plowing and digging are practiced; the trees are usually twenty feet apart each way, and are propagated principally from cuttings. The only insect yet observed consists of a small beetle. The tree fruits in the third year. Caprification is said to be practiced in New Zealand; but it is not done, so far as I have been able to learn, in Australia, and Baron von Mueller says it is unnecessary, and, in some instances, injurious and objectionable.

G. W. GRIFFIN,
Consul, Sydney, N. S. W.

FIJI.

Figs are not cultivated. The very few experimental trees that have been planted have proved a decided failure. The fruit has not been grown in these islands. A blight, black in appearance, strikes the tree before it comes into bearing, which, if it does not kill the tree, so retards its growth that it never bears any fruit.

ANDREW A. St. JOHN,
Commercial Agent, Levuka.

CONTINENT OF EUROPE.

FRANCE.

REPORT BY CONSUL TRAIL, OF MARSEILLES.

The fig tree (*Ficus carica*) that is cultivated in France was brought from Greece many centuries ago, and is now, like the olive, common to the whole of the south of France and of the adjoining countries, more especially eastward.

It grows in a wild state in almost any place and position. On many an old wall small fig trees are to be seen, and on many a roadside bank it is the tree most frequently to be found. In country farm yards, innkeepers' gardens, stableyards, the fig tree is invariably present, and very often as a solitary specimen. It would be difficult to find a garden of any description in southern France without a fig tree.

Varieties.—The varieties are innumerable, and it would be hard to give a list of all the different ones, as they vary according to soil exposure, treatment, and climate.

The chief varieties cultivated in this district are the following:

The Marseillaise, or Athens fig, a white fig of very nice, delicate taste, both when eaten fresh from the tree and when dried. This variety is considered the best in the south of France, and many people prefer it even to the Smyrna fig.

The Mouissonne, a dark fig with a fine skin, very good when eaten ripe and fresh, and good for drying.

The Barnisotte, one that is almost only eaten fresh.

There are several other varieties that could be mentioned, but they are all more or less similar to the above three kinds.

Soil.—The fig tree grows in almost any soil common to its climate, but dry ground suits it best. Along certain dry and even arid strips of land bordering on the Mediterranean, fig trees flourish and produce fruit in abundance.

Climate.—The same climate that suits the olive tree is favorable to the fig (*i. e.*, a warm climate, where excess of heat and cold is scarce). With special reference to this district it is worthy of note that on the right side of the Rhone figs do not develop very well; the fruit remains small, and is not good for drying. Whereas, on the left side, and from the Rhone till the Italian frontier, figs attain a far higher degree of quality; they are larger, sweeter, more delicate, and are excellent for drying. The explanation of this fact is, that the plains on the right side of the Rhone are not sheltered by hills, as on the other side.

Situation.—Sheltered hillsides are very favorable to fig culture; exposure to cold winds is not conducive to good results.

Rainfall.—The winter rains generally give sufficient moisture to the soil for the whole year. Fig trees that are intended to produce fruit for drying ought not to be watered artificially. Too much moisture lessens the quality and the richness of the fruit, and frequently renders drying difficult.

Tree Planting.—When planting fig trees care should be taken to select a deep soil, or in any case to dig as deep as possible and mix some fertilizer (manure, old leaves, etc.) well into the earth, on which the roots will rest. During the first two years it is always advisable, in districts

that are subject to frosts, to cover or bind the trees with straw for the winter. After the second year the young trees are generally strong enough to stand the winter uncovered. The ground should be well dug up at least once in winter and once in spring.

Fertilizers.—Fertilizers should be dug into the ground once a year, during spring, for young trees, and once every two years for older trees. Fig trees, once well rooted and well established in a place, require very little fertilizing, and this can even be dispensed with if the soil be well dug occasionally.

Pruning.—Pruning should be done once a year, but only lightly (*i. e.*, one should only thin out dead and useless branches in the body and crown of the tree, and cut away all young shoots that spring up at the foot of the stem). The latter point is important, as the fig tree being very voracious, young ungrafted shoots would only uselessly exhaust the soil and weaken the original tree. For this reason, too, it is well to keep fig trees apart from other trees, for not only does the fig tree weaken its neighbors, but its neighbors weaken it as well.

Maturity.—The fig tree produces fruit pretty regularly every year. Some varieties give two crops, the first of which begins about the twentieth of June and lasts until about the twentieth of July, the figs of which, called "Flower" figs, are not good for drying, and the second at the end of September. Several black and gray figs come under this variety.

The other kinds, of one crop only, begin to ripen about the middle of August, and continue ripening successively throughout August and September; these are the best for drying, and to this class the Marseillaise belongs.

With reference to those that give two crops, it is interesting to note that the figs of the first are borne by the branches of the previous year only, and that those of the second crop are borne by the young branches of the same year. This accounts for the latter ripening successively, as each fresh leaf that opens out bears a fig in its axil.

Picking and Curing.—Figs, either for immediate consumption or for drying, ought not to be gathered before they are quite ripe. The signs of ripeness are complete softening of the figs, slight bursting of the skin, a tear or drop of gum oozing out of the center.

Figs must be gathered by hand, and in plucking them off the branches care should be taken to pick them with the short stalk that attaches them to the branch.

The state of the weather and the time of day are points to be taken into consideration when gathering figs for drying. It is true that in this district it is seldom that the weather is not fine during August and September. However, fine days should always be selected, and picking should not commence until the morning dew has disappeared from off the fruit. As soon as the figs are picked they must be laid in rows on wicker or basket-work hurdles or boards, and well exposed, but in a sheltered position and raised from the ground, to the full force of the sun. The figs should not be placed too close together, and they must be turned round every day about midday, when the sun is hottest, so that every day a fresh surface is exposed to the direct rays of the sun. The hurdles or boards, without touching or disturbing the figs, must be taken indoors every evening and placed in dry, airy rooms till the morning, when they are brought out again in the same way. No dampness

nor moisture must be allowed to get to the figs whilst drying, and if the weather be uncertain one should be near at hand and take them in at the first sign of rain.

In fine weather six days suffice to dry figs, and this is generally the case with the first batches in August and beginning of September. But as the days grow shorter and the sun becomes less powerful, more time is required, and the process of drying lasts from ten to fifteen days. Wet weather is exceedingly detrimentel to drying, as it is a very difficult and uncertain operation to dry figs indoors by artificial heat. Artificially dried figs are never as good as sun-dried ones.

The quicker the drying takes place the better the figs are, and the exact stage of complete dryness can generally be ascertained by the firmness of a fig taken between two fingers and rolled. The interior seeds lose their red color when the fig is quite dry, and this is one of the signs that the process is completed.

They can then be classified according to size, appearance, and quality, and packed in baskets of flat wicker, or boxes, ready for storing or for shipment. They are usually packed in rows and layers, pressed down one by one with the thumb, in such a way that the stalk is in the center underneath, and then each layer should be pressed down with the aid of a small board, slightly, until the basket or box is full.

Prices.—Fresh ripe figs sell very readily at the time of the crops, especially the early ones, for a few cents a pound. No exact price can be given, as the value varies from 3 to 7 or 8 cents a pound, according to time, quantity, and quality of crop, also place where they are sold. In unfavorable seasons for drying, and in late crops, quantities are made into jam, and are sometimes even boiled into other fruit jams, such as raspberry and strawberry, to which the fig, when boiled, assimilates itself in appearance.

But the chief trade is done in dried figs, and the prices of these vary according to quality, quantity, and time of year. The grower dries his own figs and usually sells them in bulk to the dealer, who then sorts them and sells them again separately as per their respective qualities.

The Marseillaise fig brings from 75 centimes to 1.50 francs per kilogram (from 8 to 16 cents per pound), and frequently even more in retail. Other varieties sell cheaper; ordinary dark and blue figs generally bring from 30 to 40 centimes per kilogram (from 3 to 4 cents per pound). Very common small figs, dried, are sold in some districts in large quantities, packed in sacks, for distilling purposes, but this applies more generally to Italy and Spain. This kind of fig is also sometimes used, baked or roasted and ground into coarse powder, to adulterate coffee with.

Insect Pests.—The fig tree, well cared for, is very rarely attacked by either disease or injurious insects; in some regions these are unknown. In some cases a kind of a louse attaches itself to the branches and spreads over the whole tree, if not detected in time and rubbed off carefully by means of a coarse piece of cloth. If, however, it has not been detected in time, and the parasite has already covered and killed certain branches, these branches must simply be sawn off.

Reproduction.—Like the olive, the fig tree grows to a good old age. Reproduction takes place, naturally, by seedlings, but as this process is slow and uncertain, it is generally done by cuttings, which are selected from good healthy trees and planted in deep soil. They must be grafted

in about the second year, and bear fruit in their third year, after transplantation to their definite ground. If the grafting takes well, fruit is even produced before the third year.

CHAS. B. TRAIL,
Consul, Marseilles.

CORSICA.*

REPORT BY CONSULAR AGENT DAMIANI, OF BASTIA.

Varieties.—(Common fig tree, *Ficus carica.*) The varieties cultivated in this locality are, for drying, the White (*Bourgassotte Blanche*); Neapolitaine, very good quality, very good to dry, yields small number of flowers; for eating when ripe the Verdale; the Marseillaise; Athens fig, the kind best adapted; Dunmine, very good for drying; Franciscana, for drying and eating. Black (*Bourgassotte noir*), very good fresh figs; Niello noir, the earliest figs; colored (*Figue latte*), excellent fresh or dry; Observantine, very numerous flowers; Bellone, excellent fresh or dry.

Situation.—The fig tree is abundant in Corsica, particularly on the littoral, especially on well exposed hillsides, on the rocks at the foot of the mountains close to the sea, on dry ground. The roots being very long, it is cultivated in deep, calcareous soil. It grows from the sea level to eight meters of altitude. The trees grown on the plains and shoals produce figs which dry and have not the requisite flavor and whiteness. Although the fig tree grows on dry soil, often in the fissures of rocks and walls, it yields the most abundant and best flavored fruit when cultivated on good, light soil. It is affected by dampness, but yet requires watering in very hot weather.

Cultivation.—The fig tree does not require much attention; the ground has only to be dug once or twice a year and the fig tree thrives. If planted in a warm locality it assumes a goodly shape.

Climate.—It prefers a warm climate, especially in the vicinity of olive trees. Where the thermometer does not fall below 12 degrees Centigrade, it produces leaves and fruit continuously. It does not prosper without manure from farmhouses. It is multiplied by cuttings. Small branches, of two centimeters broad by twenty centimeters long, are the best.

Planting and Propagating.—The slips are put entirely under ground, except the terminal bud. The ground should be dug to a depth of at least forty-five centimeters, and the trees should be about six meters distant from each other. Figs ripen at two seasons—at the end of spring and beginning of summer, and in the autumn for the second figs. The second is the most important.

Picking and Curing.—The gathering is long, because they ripen successively. They wait till the figs are perfectly ripe, and even overripe. Those gathered unripe mature by keeping, but have not the flavor of those matured on the tree. Perfect ripeness is indicated by their being soft, the cracking and falling away of the rind, and by a liquid in the center. The day and hour are important if the figs are to be dried. The dew must have disappeared and the time must be dry. After being gathered, they are taken into the house and placed on planks or on hurdles, exposed to the greatest heat of the sun, and in a sheltered

* Translated at the Marseilles Consulate.

place, and at night in a well aired place. The form and preservation of the fig depends upon the promptitude of the operation of drying. The figs have to be burned over and flattened frequently. Sometimes during the operation of drying rain comes on; the drying then becomes difficult and almost impossible, except by means of the artificial heat of furnaces, which, however managed, injures the quality of the figs and lessens the market value by a third.

Yield.—A fig ground of a hectare, containing two hundred and sixty-seven fig trees twenty-five years old, will yield (at the rate of twelve and five tenths kilograms each, three thousand two hundred and fourteen kilograms of dried figs, of the average value of 37 francs the one hundred kilograms, and 30 francs, reckoning losses) about 963 francs. On account of the difficulties in drying, nearly one crop in three is lost, which reduces the average profit to 640 francs.

SIMON DAMIANA,
Consular Agent, Bastia.

SOUTHERN FRANCE.

REPORT BY VICE-CONSUL MARTIN, OF MARSEILLES.

The fig tree is common in southern France, and specimens of the several varieties known in the country are to be found in almost every ground lot, but it is not the object of special culture. The preparation of figs requires too much time and care, and the price could not repay hired labor. The figs must be culled one by one, when perfectly ripe; great care must be taken not to bruise the fruit or sever the peduncle. The figs are then laid on cane hurdles, exposed to the sun, and turned over every now and then until perfectly dried, that is, for a period of ten or fifteen days. As the least exposure to moisture would turn the figs black and reduce the value by one half, these hurdles have to be taken in every evening, to be again taken out every morning. The difficulties of the operation deter most farmers from undertaking it, except those that own small farms where everything must be turned to account, and that cultivate them themselves with no other help than that of their families. The small quantities thus prepared are gathered at the end of the season by commercial travelers, who pay from 1.50 to 2 francs per kilogram for Marseillaise figs (which are the most esteemed variety), and generally mix them with figs imported from Italy, Spain, Algeria, and the East. It is, in consequence, impossible to form any idea of the importance of the production, or of the proceeds. In 1882 the importation of figs from the above named countries amounted to nine million nine hundred and sixty-four thousand seven hundred and forty-three kilograms, whereas, the exportation was not even given separately, for it was included in the official returns with that of other dried fruit not elsewhere specified, amounting in all to three hundred and ninety-seven thousand two hundred and sixty-nine kilograms.

The climate of this consular district does not agree with orange and lemon trees, which are not seen in the open field except at a short distance from Nice.

J. S. MARTIN, JR.,
Vice and Deputy Consul, Marseilles.

ITALY.

REPORT BY CONSUL-GENERAL RICHMOND, OF ROME.

In Italy many varieties of the *Ficus carica* are cultivated. The widest spread of these varieties may be divided into two groups, as follows: The *Fico gentile* and the *Fico portoghese*, which are the earliest; the *Verdini* and *Brogiotti neri*, the *Brogiotti bianchi*, the *Brianzosi*, the *Datteri*, or *Dottati*, which are thick skinned. All these varieties bear fruit only once a year. The *Fico albo* and the *Fico San Pietro* bear fruit twice a year. A fig tree of medium size will yield generally from forty-four to sixty. kilograms of fruit. Usually the fig is planted in company with other fruit trees (olive, almond, and others); but fig orchards, where figs alone are grown, may be found (at Lecce, for instance), and in such cases the trees must be planted at such a distance apart that when they reach their fullest development they may not come in contact one with the other; (1) because the fig needs a great deal of sun; and (2) because, otherwise, if the partial and easily located infection called rizoctonia should show itself it would spread rapidly through all the orchard. In many places it is the custom to alternate the fig, almond, and olive, so that each fig tree may be isolated.

In Tuscany the figs called Dottati are preferred for drying. They are peeled and dried in the sun, and then, with a slight sprinkling of anise seed, are rolled into disks or small loaves. In other cases the rind is not removed, but the fig is split in two, flavored with anise or fennel seed, dried in the sun, and so sent to market.

The common purple or black figs are dried in the oven or in the sun, just as they come from the tree. At Lecce, Reggio, Calabria, Cosenza, and Cotanzaro this system is adopted. They also make a fig paste with walnuts, almonds, cinnamon, etc. It is customary to drop a little honey on them while drying.

There are coming into use stoves with hot-air chambers, especially adapted for drying figs as well as other fruits.

LEWIS RICHMOND,
Consul-General, Rome.

CATANIA.

REPORT BY CONSUL WOODCOCK, OF CATANIA.

Of the fig tree there are several varieties; some yield a large fruit, others small. The fruit also varies in its degree of sweetness; also in color from white to black. The fruit of some varieties ripen sooner than that of others. The trees grow well in poor or rich soil, and bear abundantly in our mild climate (mountain side, if not too high), or hot climate (of the valleys). The soil for the fig must be dry. It will not flourish in wet ground.

The favorite varieties here are the Sangiovannaro, the Sottuno, the Melinciano, and the Ottato. The Ottato has smooth leaves; the peduncle of the flower and fruit is longer, and the fruit is sweeter than of other varieties. The fruit of the Ottato is best for drying.

The fig is here propagated from the suckers that spring up from the roots; cuttings from the tree also are used in propagation. Cuttings in this climate should be set in the months of February and March. In

orchards the distance to be maintained between the trees is eight meters (twenty-six feet). The fig is long lived, because it is constantly being renewed by shoots that put up from the roots, taking the place of the main trunk when it becomes old and decayed. The soil must be worked in the spring; also, in November following. The best varieties are grafted, also budded upon the stock of the wild fig. Grafting and budding are also done upon healthy trees of the best varieties. The time for pruning is in March, or when in blossom in June. All dead and diseased branches should be cut away. But little pruning is necessary. Too much is injurious.

Figs here are dried in the following manner: The fruit must be gathered when partially ripe. It must not be what is termed "dead ripe;" in other words, it must be more green than ripe. When gathered, give the fruit a plunge bath in boiling water, removing them from the water quickly. Then place the fruit in a shady place. The next morning at sunrise spread the same upon a platform (not upon the ground, because of its dampness), that it may be flooded with sunlight. Here shallow willow-work baskets are used for holding the fruit while drying. These are never placed upon the ground, but in an elevated position. At going down of the sun the fruit must be covered to protect it from the night dews or unexpected showers of rain. Continue thus for several days until the fruit becomes dried.

When dried, place the fruit in layers in small boxes or baskets, artistically and neatly arranging the same. Press the fruit down firmly by hand, and continue the layers of fruit until the vessel is full. The boxes (or baskets) must be securely covered and kept in a dry place.

The culture of the fig is not a specialty in this part of Sicily; but little of the fruit is exported from this district, and none from Catania to the United States.

The raisin grape is not cultivated here. The grapes grown in this part are manufactured into wine.

ALBERT WOODCOCK,
Consul, Catania.

MESSINA.

REPORT BY CONSUL JONES.

Varieties.—The best varieties for drying are the *Fico albo*, or white fig (round), and the *Fico petrociano*, or purple fig (oblong). The best varieties for eating, when ripe, are the Brogiotto, the Adottato, the Graziano, the Catalano, the Palermitano, the Verunio (winter fig), and the Lardaio.

Tree Planting.—The above named varieties are grown throughout this province. They are not planted by themselves, but are scattered through the vineyards, groves, orchards, and pasture lands.

Distance from Sea.—The fig thrives ten miles from the seashore. The Brogiotto and the Petrociano do better near the sea than any other varieties. The Graziano is illy adapted to low levels and sea breezes.

Elevation.—The fig does well at an elevation of two thousand feet above the sea level.

Exposure to Sun.—All exposures suit the fig. A northern exposure is the least desirable.

Position.—Hillsides suit the fig best. At but a slight elevation above the sea the fruit is insipid, and soon spoils. The finest trees are to be met with at an elevation of from nine hundred to one thousand two

hundred feet above the sea. Upland fruit has the highest flavor, and the best keeping qualities.

Soil, etc.—The fig delights in a friable, dry, and somewhat cold soil, composed in special of the detritus of calcareous rocks. It shuns wet and marshy soils. The best soils for figs for drying are hillsides of disintegrated calcareous rocks of the Tertiary and Quaternary periods. Soils in which sulphur abounds are excellent for the fig.

Climatic Influences.—Spring frosts and autumnal fogs are disastrous to the fig; the former kill the young buds, and the latter cause the leaves to fall off, which prevents the fruit from ripening.

Temperature.—The fig requires a temperature of from 28 degrees to 95 degrees Fahrenheit; average temperature, 66 degrees Fahrenheit.

Rainfall.—The fig requires from twenty-two to twenty-eight inches of rain annually. It suffers greatly during protracted droughts. Spring and summer rains are always of benefit to the fig. September rains are most injurious; they are heavy, and so charged with nitrogenous salts that they cause the nearly ripe fruit to split.

Irrigation.—Irrigation is not required by the fig. When grown in orange and lemon groves which are subject to irrigation, the fig produces a large crop, but its fruit is inferior in quality, and is lacking in keeping qualities.

Cultivation.—The fig might well be called the pariah amongst plants. It is rarely worked; occasionally the soil is stirred around the base of the tree (in November). When grown with orange and lemon trees, vines, etc., being worked when they are worked, it comes into bearing early and dies early.

Fertilizers.—In this district the fig is not even fertilized with its own leaves, which are gathered and fed green to cattle. Stable manure does not suit the fig; ashes and rags are better adapted to it.

Pruning.—The fig is never pruned, as pruning causes the wood to rot; dead branches only are removed.

Picking and Curing.—Figs for drying are left on the trees until they are overripe and soft. The season for gathering depends upon the time of flowering. The varieties that produce two crops a year, such as the *Fico albo* and the *Fico petrociano*, bear their first crop in June and July, and their second crop in September and October. The fruit of the one-crop varieties, the Brogiotto, Graziano, Catalano, ripen in September and October.

Figs for market are gathered at sunrise or at sunset. Figs for drying are gathered at noon.

A small plot of land, near the farmer's house, is carefully swept and inclosed by a temporary brush fence. In this space large flat trays, made of reed cane, are laid on the ground, and the figs to be dried are spread out upon them. The figs are turned over daily at noon until they are thoroughly dried. They are left out at night unless it rains. Some figs are dried whole, others are cut in two. When dried the figs are strung on pieces of split cane twenty-four inches in length. If a fig does not split open when pressed between the first finger and thumb, it is thoroughly dried and ready for exportation.

Should it rain on figs put out to dry, they are put in an oven and dried. Figs dried in an oven are inferior to those dried in the sun. These figs are never dipped in any kind of solution whatever. They are

cured simply as above stated. The exporter, not the grower, boxes this fruit.

Planting and Propagating.—Properly speaking, there are no fig plantations. Figs should be planted from twenty-four to thirty-six feet apart; dwarf varieties from fifteen to twenty-four feet.

The best varieties are propagated by budding. The fig is also propagated from cuttings—the cuttings are set out in winter; no manure is used. Old fig trees are cut down, and the most vigorous shoot sent up by their roots takes their place.

Maturity.—Very few trees live forty years. The fig begins to bear the year it is set out, and goes on bearing as long as it lives. At twenty years it produces its maximum crop.

Insect Pests.—The *Coccus ligniperda*, a large night moth, destroys nearly every tree that it attacks. The homopter (*Columnea testudinata*) covers the trees with little pustules (fig tree scale or mange) as it feeds on the tender twigs, leaves, and fruit. Remedies: Bleed the tree or sprinkle it with a mixture of kerosene and water—nine tenths water to one tenth kerosene.

The *Halterophora hispanica* eats into the pulp. Remedy: Smoke the tree during July and August with sulphur fumes.

There are no parasites of the injurious insects of sufficient importance to mention.

WALLACE S. JONES,
Consul, Messina.

NAPLES.

REPORT BY CONSUL CAMPHAUSEN.

Varieties.—The name of the best variety for drying is the Dottato, and for eating when ripe, the Twiano. The other varieties worthy of culture and for profit are the Samese, the Nerolello, and the Paradiso.

Situation.—The trees that produce the varieties above mentioned are grown in the Province of Naples. The Twiano is largely cultivated on the plains of Sorrento, where it attains a height of from thirty to forty feet and eighteen inches in diameter. Some trees reach a height of fifty feet, and yield about nine hundred pounds of green fruit per year, which matures between August and the first half of October. Some of these trees grow about two thousand two hundred feet above the level of the sea in Mojano, near Sorrento; but fig trees grow generally on land varying from three hundred to six hundred feet above the level of the sea. Figs are also largely cultivated in Basilicata and Calabria.

Climatic Influences.—Rain is very beneficial to the trees and also to the fruit. What was said regarding the climatic influences regarding lemons and oranges, applies also to figs. During the months of June, July, August, and part of September, there is generally no rain at all, but the atmosphere is moist and vegetation hardly ever suffers from drought.

Irrigation.—Fig trees do not require any irrigation; neither are the orchards cultivated nor fertilized.

Pruning.—Every two years in the month of January, in the usual manner.

Picking and Curing.—They are picked from July to September, when they begin to soften and the skins burst. After they are picked they are cut in two and dried in the sun, and finally put in boxes. They are

not dipped in any solution. The treatment is very simple, about like the drying of apples in the United States.

Planting and Propagating.—The trees are planted about thirty feet, and propagated from sprouts, slips, or graftings. (All trees in this district are propagated from sprouts.) The orchards are of all sizes. They (fig trees) are usually planted among other trees.

Maturity.—Sometimes one hundred years, bearing all the time.

Insect Pests.—The *Cocciniglia*, which must be looked for and destroyed by hand. There are no beneficial insects.

Cuttings.—Cuttings may be secured by writing to Dammann & Co., at San Giovanni a Teduccio, near Naples.

EDWARD CAMPHAUSEN,
Consul, Naples.

PALERMO.

REPORT BY CONSUL CARROLL.

The introduction of the fig tree into Italy is so remote that it is difficult to even approximate the period thereof. Pliny refers to a tree which existed long anterior to the founding of Rome, under which the citizens of that city were wont to assemble to discuss the topics of the day, years thereafter. Tradition ascribes this tree to have been that under which Remus and Romulus were found, and in commemoration thereof it was preserved.

The fig tree grows spontaneously in the arid wastes of Greece, Asia, and northern Africa. The fig is not, properly speaking, a fruit, but the receptacle of vast quantities of flowers, occupying the interior thereof, which, upon the completion of fecundation, mature seeds; the receptacle growing and thickening, acquires all the qualities of one of the best fruits.

In countries where the thermometer does not fall below 59 degrees Fahrenheit, the growth and maturing of the fig proceed without any appreciable interruption; but in colder countries, upon the advent of the first frost, the fig tree loses its leaves, and those seed receptacles which, under favorable circumstances, would have continued to develop, harden and remain inert until the following spring, when, with the return of warm weather, they resume their growth, being the first to mature in the summer. The figs thus resulting are denominated "fig flowers," in order to distinguish them from those which first appear in spring and mature later.

In hot countries the fig tree grows to large proportions, and in isolated and favorable localities it assumes a beautiful form, without need of modification or pruning. Its branches project themselves regularly toward the earth from year to year, and finally reaching and entering it they throw out new roots, thus forming additional sources of propagation.

The tree prospers best in a deep, rich, moist, calcareous soil, but in a warm climate it will grow in almost any soil.

The fig tree is propagated from the seed, slips, and roots, as well as by grafting, but the former method is rarely resorted to on account of the slowness thereof, and only under peculiar circumstances.

A good method to propagate the fig on a large scale is to amputate a young tree at a point of about two inches from the ground, and as a

result, and soon thereafter, a myriad of sprouts or branches present themselves, which, in due time may be bent, and the ends thereof buried in the ground to the depth of a few inches.

After the branches in question take root they should be amputated close to a joint, thus detaching them from the parent tree, each of which then being a separate tree, may be planted at pleasure.

There are many varieties of figs, differing in size and color, the white growing larger, and, in a fresh state, not standing transportation.

The fig in most favor here is that known as the "Indian fig." It is a native of South America, and is the dried fig of Italian commerce. It only prospers, however, in southern countries, and in calcareous ground without too much moisture, etc.

PHILIP CARROLL,
Consul, Palermo.

SICILY.

REPORT BY CONSUL LAMANTIA, OF CATANIA.

Varieties.—The name of the best variety for drying is the Dottato, an excellent quality of fig largely cultivated. Figs with fine peel and small seeds are also worthy of culture and best for drying.

The names of best varieties for eating, when ripe, are the Sangiovannaro, the Datternolo (an early fruit), and the Natalino (a late fruit).

The other varieties worthy of culture and for profit are the Melanzana, the Olivuzza (a small fruit), and the Ficazzana (a very large fig).

In reference to the latter, I desire to mention it, for the reason that it is an extraordinary large black fruit, bearing twice a year, viz.: about the end of June; and the second crop, larger than the first one, commences in August and lasts till the end of October. This fig, however, is not for drying purposes, but simply for eating when fresh. The fig is so large that six generally weigh about two pounds.

Situation.—The trees producing said varieties grow around Mount Etna, as well as in the low lands of this province, from three hundred to six thousand meters from the seashore, and from five hundred to six hundred meters above sea level. When exposed to sun, on level ground, they yield more fruits, but those on hilly, rolling land produce them sweeter. The same grow also by the seacoast, and either in poor or rich soils. The soil must be rather dry, for in wet ground the fig tree does not flourish well.

Climate.—The minimum temperature is 5 centigrades in January; the maximum, 35 in August, and 17 average in May.

The sweetest drying figs are grown in mild climate land, while those in warm regions are fit for eating when fresh. Rainfall in this province is known to be at an average of twenty-five to thirty inches per year. Rain favors these fruits greatly when they are small, before maturity; but when full ripe it hurts them badly, making them lose their natural, sweet flavor.

Irrigation.—Irrigation is never resorted to, the rainfall being sufficient.

Cultivation.—Cultivation is very simple, and it does not require much labor to be done. A good digging in summer and winter time is more than sufficient. The planting is seldom done by rows, and the trees are generally spread out through vineyards and olive groves, where they grow and bear well.

Fertilizers.—This plant, as a rule, is never manured in Sicily; but in

arid lands it is always better to remove from time to time the ground, in order to give its base some fresh air.

Pruning.—Pruning is done by cutting off all the dead branches, and the best time to do so is in the months of March and June, or when the pitch is dry. In hot climates, however, pruning is not necessary, for the reason that the plant is one of those which, left to itself, yields always many fruits.

Picking.—Picking is done when the fruit is fully ripe, and generally not before the sun is up, so that the fruit is dried from the night dew. The process of drying is very simple, and is as follows:

Curing.—When the figs are thus gathered they are cut in two, and so set on planks and exposed to the hot sun's rays for drying. Every once in awhile they are capsized, to be dried on both sides. In the evening, however, they are taken into houses, or are well covered, to protect them from the night dew, dampness, or rain. After four or five days, when they are sticky dry, they are pressed by hand, facing one another together on the pulp sides, and then they are passed through with a big needle and twine and formed in *reste* (traces) of about two feet long. Others, dried in the same way, are passed through small sticks and formed in *chiappe* (square tables) of about one and one half feet each way. After this has been done, the figs so dried and prepared are dipped for a few minutes in hot water, to prevent them from fermentation, and exposed to the sun again for drying.

The small figs, however, are picked, dried, and cured in the same way—but not cut open—and pressed and packed, with some laurel leaves, in boxes containing twenty-five pounds, and in round or square baskets for shipping, many of which are exported to the United States.

Planting and Propagating.—The distance planted apart is from twenty to thirty feet. They are not planted in rows, but are generally scattered in vineyards and olive groves, where they grow and produce well. Propagation is generally done by *succhioni* (suckers) springing from the roots, or by *talee* (cuttings). Seeding propagation is seldom used, as it is difficult, and trees so obtained take a long time to bear. The orchards are small ones in some localities, while in others are pretty large and give favorable production.

Maturity.—The fig tree lives very long and is almost perennial, for the reason that shoots springing from the roots take the place of the old trunks on decaying.

Insect Pests.—The insects injuring the fruit and tree are: The Bostrico (*Bostricus fici*), the Cocciniglia (*Ceroplastes caricæ*), and the Psylla (*Psylla fici*).

The Bostrico is a very small insect, which digs a gallery in the trunk, under the bark, causing the tree to rot and die. Said insects, during the fall and winter, abide in lethargy under the bark of the tree; and in summer, after they have joined together with the females, go on the branches to deposit their eggs.

The "cochineal" is known from the remotest times. At first blushing it appears like a small piece of whitish wax, and, in fact, this insect, from its chemical composition, is of a wax nature, and, like the other cochineals, the females protect under them their eggs, and when dead their corpses act as a covering. The fig tree, badly attacked by the said insect, follows the same phenomenon as the olive tree and acid fruit trees in similar conditions. The leaves become covered with a sort of

black smoke, owing to a very small microbus (fumago) generating from the sticky substance which forms the so called melata (sugar and gum) perspired from the leaves, on account of the cochineal's presence, although they stay on the branches and not on the leaves. The damages brought the fig tree by the cochineals it is useless to speak of, as they are identical to those caused by other cochineal and aphis. To destroy the same, it is necessary to cut all the branches off, when badly attacked, and burn them.

The Psylla is quite different from the olive Psylla. It generally lives on the leaves, sucking their humors and causing the tree to become quite a skeleton. Besides destroying them, the branches thrive ill, the fruits fail, and the tree remains damaged. The insect is a little larger than the olive's Psylla, with greenish body and large, transparent wings. The larva seems to have no waxen secretion, from the fact that no such substance is seen on the leaves like soft cotton.

VINCENT LAMANTIA,
Consul, Catania.

PORTUGAL.

THE AZORES.

A considerable quantity of figs is produced, but they are consumed in a fresh state, with the exception of a small proportion converted into an ordinary brandy for home consumption. Scarcely any are dried, the climate being unfavorable to the operation.

S. W. DABNEY,
Consul, Fayal.

SPAIN.

MALAGA.

REPORT BY CONSUL MARSTON.

Varieties.—The names of the best varieties for drying and eating when green are the *Hijo Verdijo*, thin skin, white, and very sweet when green and ripe; the *Hijo Blanco*, a white fig with harder skin; and the *Hijo Panetejo*, brown in color, inclined to purple. All the above are good to eat either fresh, or as they say here, "green," or can be dried as figs. The quality is in accordance with the order in which they are given, the first being considered the best, the second the second best, and the third inferior.

The trees that produce the varieties of above named figs are grown throughout all the provinces of Pralaja, Granada, Almeria, Sevilla, and all other provinces of southern Spain.

Situation.—Distance from sea, two kilometers; elevation above sea level, one hundred feet. The more sun the better. Hilly land is the best. Sandy subsoil is best.

Climatic Influences.—Temperature, 45 degrees, 90 degrees, and 78 degrees Fahrenheit. No record of rainfall to be had here. The trees require no more water than falls naturally in rain.

Irrigation.—No irrigation for figs.

Cultivation.—Dig around the roots in the latter part of November or December, to the depth of eighteen inches, and use stable manure.

Fertilizers.—None used here.

Pruning.—In the month of December, by cutting the ends of all projecting branches.

Picking.—In the month of August, when fully ripe, and when the sun is shining brightest.

Curing and Packing.—When the figs are quite ripe they are picked only on fine days, during sunshine, and are cured in the same way that raisins are dried. The sun furnishes all the heat required. It is enough to construct simple divisions, made of either brick or stone, exposed to its rays, in an inclined position, say ten yards long and two yards wide. The divisions or apartments are built up at one end with a sort of triangular masonry, which, from afar, gives them the appearance of a range of uniform tombs. The triangle is so constructed that the sun, during clear days, never fails to shine upon the contents, the interior of these divisions or compartments being filled with fine gravel, which attracts the heat.

Immediately after picking the figs are placed in these divisions, and are exposed to the heat of the burning Andalusian sun of August. Never, it appears, have they dreamed of ascertaining the degree of heat thus obtained, but the experienced cultivator affirms that they do, during the heat of August, attain a temperature of 145 degrees Fahrenheit.

At nightfall a very simple method of covering is applied to guard the figs from the heavy dews or rain, either of sail cloth or heavy canvas, so arranged that it covers entirely the figs that are drying within, and being supplied with rings on the two sides, slide up and down as a curtain at a moment's notice. In many places planks or boards are used for covering, giving the appearance of a sort of roof. The figs, during the process of drying, which occupies from ten to fifteen days, are turned over and over, in order that they may dry and color uniformly. When completely dried, they are then packed in boxes, or frails, the latter made of the palm leaf dried, nailed or sewed up, and are then ready for shipment. They are not dipped in any solution.

Planting and Propagating.—Planted apart about five yards, and propagated by planting a branch when the tree is beginning to bud. The orchards are mostly large.

Maturity.—The tree begins to yield in six years, and lives seventy-five to one hundred years.

Insect Pests.—There are no insect pests or parasites.

H. C. MARSTON,
Consul, Malaga.

TURKEY.

REPORT BY CONSUL-GENERAL HEAP, OF CONSTANTINOPLE.

Production.—The fruit of the fig tree may be reckoned among the staple foods of man for ages before cereals were cultivated by any settled agricultural population. In the temperate regions, where it thrives best, it fills the place of the banana of tropical climates, and yields fruit during several months of the year. In Asia Minor, where the tree is found wild, and where the best figs of commerce are grown, it is extremely fruitful.

The best figs for drying come from the valleys of the Meander and the Kaistros, to the south of Smyrna, where the trees are planted with

great regularity and care, and the ground is dug and hoed from four to six times during the summer. When the figs reach Smyrna they are sorted by women and packed in boxes by men. They are best when newly packed, and as months go by get drier and harder in the warehouse. No one who has not eaten them in the Levant, packed in the ornamental drums in which they are sold for local consumption, knows what the best figs are like. The cardboards of the fig boxes are supplied chiefly by Belgium and Austria.

Two seasons ago fifty-four thousand camel loads of four hundredweight each had reached Smyrna by the twenty-second of October of that year; and the production increases annually. Fifteen years before that time not more than half that amount was recorded for the whole season.

England, Germany, and the United States take the greatest part of the figs exported. France, where the smaller and much inferior figs of the Mediterranean are consumed, takes little of the finer kind of the figs of Smyrna.

The improved facilities of transport which have so much increased the stock brought to market, have also brought down prices. Taking averages, prices ranged about ten years ago from $4 08 the kintal (one hundred and twelve pounds) for Aidin figs, to $8 75 for Elémés, while the very best, the Ekinis, sometimes brought $19 22 the kintal, or nearly 16½ cents per pound. Now small parcels of excellent quality bring about $6 60 the kintal.

Although throughout the world there are to be found about one hundred different species of figs, only some five or six kinds are cultivated in this country. Of these, the best description are called Elémé, and are grown most largely and in the greatest perfection in the districts around Smyrna; but considerable quantities are also grown in other parts of Asia Minor. The fruit is of various colors, from deep purple to yellow or nearly white. The tree usually bears two crops, one in the early summer, from the buds of the previous year, and the other in the autumn, from those of the spring growth. The last forms the chief harvest.

Yield.—The trees are propagated by seeds and suckers, and frequently by layers and cuttings. When young they require care in pruning, and the immature fruit formed late in the summer should be removed to strengthen the shoots.

The *Ficus carica*, which yields the well known figs of commerce, is a bush or small tree, rarely more than eighteen or twenty feet in height, with broad, rough, deciduous leaves very deeply lobed in the cultivated variety, but in the wild plant nearly entire. After the young tree attains maturity it receives but little care beyond being occasionally lopped in places, and being well manured in the fall of the year. The fruit begins to ripen at the end of June, and the summer yield, which gives employment to a large population, comes to market in immense quantities in September and October. The trees sometimes give a third crop, which ripens after the leaves have fallen.

Curing.—When ripe, the figs are picked and spread out to dry in the sun, the sugar which they contain in abundance being thus rendered available for their preservation, those of better quality being much pulled and extended by hand during the process. Thus prepared, the fruit is packed closely in barrels, rush baskets, or wooden boxes, for commerce. Recently the practice of preserving fresh undried figs has been adopted,

but the amount used in that form is as yet insignificant compared with the quantities that are preserved by drying.

Observations.—Figs, especially when fresh, are largely used by the local population as an article of food. The trade in this fruit is of long standing and of very considerable importance in this country. During the year 1880–81 Smyrna District exported six thousand nine hundred and ninety-one and one half tons, worth at the port of shipment $1,646,-998 89. The exportations were principally to England, Germany, the United States, and France. In one fortnight no fewer than one hundred and ninety-five thousand barrels, cases, bags, boxes, drums, and baskets of figs and raisins were shipped from Smyrna alone. The export trade of figs at the other Turkish ports is unimportant in comparison with Smyrna. Figs are grown largely in the other provinces of Turkey, but the quantity exported is small compared with Smyrna. They produce but little more than is sufficient to meet the local demand; but if railroads existed in the interior, the production would be immensely increased.

It is probably not generally known that a considerable quantity of the inferior kinds of figs find their way to the Austrian "chicory coffee makers" and the French brandy distillers. Much liquor labeled "fine champagne," "cognac," etc., owes its origin to the refuse of the Smyrna fig market.

G. H. HEAP,
Consul-General, Constantinople.

DARDANELLES.

REPORT BY CONSULAR AGENT CALVERT.

Varieties.—Figs are not dried here. The best variety for eating when ripe is the Syah Ingir (black fig).

Trees.—Very few trees of other kinds are cultivated. The trees producing the figs are grown in Thracian Chersonese, Dardanelles Coast, and elsewhere. They are planted from the sea inland, but not above one thousand five hundred feet, and open to all exposures.

Soils, etc.—All soils and position, rocky ground with sunny exposure, produces the best flavored fruit. Alluvial, light, and stony soil in general; hard subsoil is best suited to the fig.

Climatic Influences.—Rarely above 90 degrees or below 5 degrees Fahrenheit.

Rainfall.—Thirty inches per annum. Much rain is apt to cause the fruit when ripening to split and decay.

Irrigation.—Irrigation is not practiced.

Cultivation.—No method of cultivation practiced.

Fertilizers.—No fertilizers are applied.

Pruning.—No pruning. Suckers are removed.

Picking.—When the fruit matures the early morning is the best time for picking.

Planting and Propagating.—Trees are planted from fifteen to thirty feet. The ordinary method of propagation is to take a cutting (or branch *torn off* preferred) three to four feet in length, with terminal bud. A trench about twenty inches deep is made, the branch is layered with the end projecting four to eight inches above ground. If the summer be dry, a little water is given the first year. Suckers and spray-wood are

not generally planted (unless to be grafted like the wild fig), as they produce fruit inferior to that of the parent tree.

Orchards.—All sizes.

Maturity.—Fifty to a hundred years. Fruitful till decay. The stem, when it decays, is almost alwas replaced by its offshoots.

Caprification.—A contested question is that of caprification. The prevailing idea is, the parasite of the *Ficus carica*, or wild fig (called by the natives the male fig), fertilizes the cultivated tree. The *Blastophaga grossorum* and *Cynips sycamori* are now recognized to be the apterous male and winged female of the same insect. So rooted is the idea, that in a year of scarcity the puff figs are sold at $2 and $3 per pound, to suspend on the cultivated fig tree. A series of observations have been made to test the theory in different countries. I was requested by Sir S. Saunders, of the Entomological Society of London, to contribute by the examination of the fig trees in these parts. Like all the other observers, I found the parasites and their ichneumonidæ in abundance in the wild fruit, but failed to discover any trace of these insects in the cultivated fruit at any stage of its development.

Insect Pests.—A kind of blow-fly sometimes attacks the fruit when mature, especially when damaged by rain.

The matter relating to the parasites was published in the "Entomological Monthly Journal" (London). No Government statistics exist.

FRANK CALVERT,
Consular Agent, Dardanelles.

CONTINENT OF AMERICA.

MEXICO.

LA PAZ.

REPORT BY CONSUL VIOSCA.

The Spanish or Moorish black fig is the best for preservation and for palate taste, and is very juicy once dry. The best varieties for eating, when ripe, are the Bordeaux and Smyrna white fig, but the early black Moorish (*breva*) is superior. Dried figs are an important export industry in this country, and their growth is found in every watering place or valley in this country. Trees are generally planted in limish and sandy soil, and whenever the soil is too rich, ashes of any kind mixed in the soil is its best fertilizer. Never use manure or guano; it is the worst enemy of the fig tree; the fruit becomes tasteless, and besides attracts the insect pest called *Conchita* (turtle shell).

In pruning time, which is in October, the tree is simply cleaned out of dry branches or young ground-root shoots.

Picking and drying takes place in May and June, before the first rain falls. Early figs in April and part of May.

In this country the fruit is simply spread on the top of the house's roof or on mats, with full sun exposure all day, and at midnight it is taken into the houses.

JAMES VIOSCA,
Consul, La Paz.

ECUADOR.

The only kind of fig grown in Ecuador is the purple.

Though the fruit does well it is grown only in a small way. The trees should be subjected to treatment similar to that of the orange and lemon, in which respect the requirement is lived up to in Ecuador, all being neglected. A tree in full bearing will yield about one hundred pounds of fruit.

None of the fruit is dried in Ecuador. All that is grown is consumed fresh or made into sweetmeats.

HORATIO N. BEACH,
Consul, Guayaquil.

CONTINENT OF AFRICA.

MOROCCO.

REPORT BY CONSUL MATHEWS, OF TANGIER.

Varieties.—There are various kinds of figs—white, red, and black—which are dried for commercial purposes. Of the white variety there is the White Burgasot, of excellent flavor both fresh as well as dried. It does not produce the early large fig, but only second season figs.

The Marseillaise, or Athens Fig.—Fruit very sweet and small, round in shape; it ripens in August, and is the variety most preferred for drying.

The Blanquette Fig.—A middling variety, which resists cold weather better than any other varieties, and can prosper north of the regions of the olive; is also of second season, and is preferred while ripe before drying.

Of the red varieties the best for drying are the following: The *Date fig*, the most preferred for drying purposes; it ripens in August. The *Jerusalem fig*, matures in September; very fine and large. The *Rose Blanche*, very large, and is only used for drying. *Sultana*, or *Tunisian*, a large, choice variety similar to the Smyrna.

There are numerous varieties of black figs, bearing a different name in the various countries where they are grown.

Morocco produces a large variety of most delicious figs. They are called by the Arabs "Kermuse" in general, although each variety has its name. There are figs of various colors, some of which are white, yellow, black, purple, and others green. The Jews extract "aguardiente," an ardent spirit, from figs. In Spain they prepare a savory wine from which they extract spirits, which they flavor and term "anisette."

Suffren has given a description and figure of three hundred and sixty varieties of figs cultivated in Spain, France, and Italy. Most of the fig trees yield two crops during the year; the first, producing the large fig, matures in June, and the second in August, September, and October. The fig tree grows on any soil, provided it is free of stagnant water retained on the surface over the roots. It prefers a light loam of a calcareous nature; should this retain its moisture the trees would grow taller; in dry soils the fruit is smaller.

Planting and Propagating.—The fig is propagated from seed, shoots, suckers, slips, stakes, layers, and by grafting. From seed is only practiced by some to discover new varieties. In raising from slips or

stakes, these should be chosen from vigorous branches of the shoots of the previous year, and about twenty-six inches in length. The proper time is either in February or November. A hole is opened about two and one half feet deep; good manure and a little lime should be well mixed with the soil which is dug out of the hole. The slip or branch is then laid horizontally, leaving out the last eye perpendicularly, which on shooting out will form the tree. Budding or grafting is seldom practiced in fig trees. The distance between trees should be sixteen feet. During the heat of summer of the first two years the young plants should be watered.

Fertilizing.—Manuring the trees will greatly increase their crops. They require no pruning, only removing dry branches and new shoots from the trunk. When the tree obtains age it requires no cultivation. It is well to cover with straw the branches of the trees while from one to three years old, in the winter in cold climates, to protect the eyes from frost, after which the trees become hardier as advancing in age. There are male and female trees; the male is the wild, or goat fig.

Male and Female Fig.—There should be amongst the fig orchards some of the masculine species, as those trees producing the small variety of fig, and which yield so abundantly, require the proximity of the male sort to come to full maturity and size, otherwise the fruit drops before coming to maturity. In the absence of male trees in an orchard where these varieties are growing, the male figs, which are very small, and unfit to eat, are brought and hung to the branches of the feminines. The wild fig produces a multitude of small insects of the genus *Cynips*, which, settling on the fruits of the cultivated trees, convey the pollen with which they are infected. This is a practice from time immemorial.

Maturity.—The fig trees commence to yield fruit when they are three years old, and come into full bearing when they are twenty years of age. From one hectare of land the yield generally is about four thousand kilograms of dried figs, at value of $5 per one hundred kilograms; total, $200.

Yield.—As an example of the great yield of the fig tree, I may cite some trees at San Pedro del Pinatar, Spain, which produced each as much as $12 of early figs, besides one hundred and fifty pounds of dried, sold for $3, and seven quintals of second size figs, sold for $9 50, which makes the yield of each of these trees, in full bearing, annually, to the amount of $20 50.

Curing the Fig.—The fruit must be gathered when quite ripe, when they commence to dry on the tree, on a clear sunny day, after the dew has dissipated. They are exposed to the sun in lattice work made of canes or slips of boards, or in rough straw mats placed from the ground, allowing, if possible, the air to circulate under. The figs, after a few days, are pressed one by one into shape, to facilitate their curing. After sunset the fruit is removed to a dry and well ventilated place for the night. This operation is followed until the figs are perfectly cured. When they are selected, the various sizes are spread on sheets for a few days in a ventilated place, the windows of which must be closed when the atmosphere is damp; and, lastly, the figs are pressed downwards on a table, to give them a round shape; then they are packed in boxes lined with paper. The boxes must be kept in a dry and ventilated room. The common figs are packed and pressed in mats.

FELIX A. MATHEWS,
Consul, Tangier.

CRYSTALLIZATION OF FRUIT IN FRANCE.

MARSEILLES.

REPORT BY CONSUL MASON.

The business of preserving fruits by the crystallizing process is peculiar to southeastern France, and is practiced on a large scale at Apt, in the Department of Vaucluse, at Clermont, in Auvergne, as well as at Marseilles, Grasse, Avignon, and other places of less importance.

The product is exported largely to England, the United States, and various other countries, including Algiers, the East and West Indies, and even South America, where the profusion of fresh fruits would seem, at first thought, to render such an expensive import almost superfluous.

The kinds of fruit preserved by this process are mainly pears, cherries, apricots, pineapples, plums, figs, citrons, oranges, melons, and a kind of dwarf orange called "chinois," which grows to some extent in the District of Nice, but is imported here mainly from Italy and Corsica. Peaches are used for this purpose only to a limited extent in the region of Marseilles, the "freestone" varieties being too costly and the supply too small for profitable use on a large scale.

The crystallizing process is in principle simple and nearly uniform for all the above kinds of fruit, but it requires a certain skill and delicacy of manipulation which can only be obtained by experience, and which it is difficult to precisely define.

The essential thing to be done is to extract the juice of the fruit and replace it in the pulp with liquid sugar, which, upon hardening, not only preserves the fruit from fermentation and decay, but retains it in its original form and consistency. For this purpose it is necessary that the fruit should be fresh, clear of all decay or other blemish, and of precisely the correct degree of ripeness. This last is an important and difficult requirement, as the proper degree of ripeness for crystallizing varies with the different varieties, and is so precise as to exclude from use for this purpose much of the fruit sold during the season in open market, and which has not been gathered, assorted, and transported with sufficient care.

Supply of Fruit.

In the neigborhood of Apt and Avignon, where this method of preserving forms a leading industry, fruit growers are carefully instructed in this respect, and deliver their crop to the confectioners in the best condition. Contrary to what is popularly believed, native fruits are rarely or never really cheap in southern France, except sometimes for a brief period, when, by reason of some exigency of weather or sanitary trouble, the supply of apricots, figs, or melons may temporarily exceed the demand.

Oranges, which come from Spain and Italy, and citrons, from Corsica and Algiers, are, in favorable seasons, plentiful and reasonably cheap; but apples, pears, cherries, peaches, plums, and berries are always costly in the market of Marseilles. At this time, the end of October, ordinary apples command, at retail, from 4 to 8 cents per pound, and the average

price paid by confectioners for the various fresh fruits used in crystallizing varies from 8 to 10 cents per pound.

At Apt and Clermont, which are small towns in the midst of fruit-growing districts, prices are somewhat less than this. Refined sugar, the other principal material, costs $9 65 per one hundred pounds. If moist or inferior sugars are used, this item of expense may be slightly reduced, but the saving thus effected is more than lost by the inferior quality of the product. This is exemplified by the Corsican citron preserved at Leghorn.

It will be borne in mind that the preserved fruits under consideration are of two kinds, "*fruits glacés*," glazed, and "*fruits crystallisés*," but this difference relates simply to the exterior coating of sugar, which results from the final stage of the process. Until that finishing process is reached, the method of preparing glazed and crystallized fruits is identical, and the value of the product is the same.

The Process of Crystallizing.

The fruit is first carefully assorted in respect to size and uniform degrees of ripeness.

Pears, pineapples, and quinces are pared, citrons are cut into quarters and soaked a month in sea water, and the "pits" of apricots, cherries, and peaches are carefully removed.

Even this preparatory process requires a certain degree of skill, since the stone must be removed with as little injury as possible to the form and solidity of the fruit. This work is done mainly by women, who earn thereby 50 cents per day.

Thus prepared, the fruit is immersed in boiling water, which quickly penetrates the pulp, dissolving and diluting the juice, which is thereby nearly eliminated, when the fruit is subsequently taken from the water and drained, leaving only the solid portion of the pulp intact.

This process of "blanching" must also be done with exact nicety, the period of immersion in the hot water being determined by the size and ripeness of the fruit. If immersed too long the pulp is either overcooked or is left too dry and woody. If taken out too soon the juices left in the pulp prevent perfect absorption of the sugar afterwards, and, by eventually causing fermentation, destroy the value of the product. In this, as in other stages of the process, the only guide is experience. A skillful workman can tell by the color and appearance of the pulp when it is properly "blanched," and this knowledge invariably commands employment and liberal compensation.

After being thus scalded some fruits, apricots, for example, are again assorted into two or three classes, according to the degree of softness that has been produced, for the reason that if kept together they would take up the sugar differently, some losing their form entirely, while others would remain sufficiently impregnated. For these different grades, sugar syrups of different degrees of density are required, the softer the fruit the stronger the syrup required for its preservation.

For the same reason, each of the different varieties of fruit requires a syrup of corresponding strength.

Pears, citrons, and pineapples, which remain hard and firm, take best a syrup having a density of from 18 degrees to 25 degrees, while apricots, plums, and figs are treated with syrups which gauge from 30 degrees to 40 degrees by the aerometer.

The requisite syrup having been prepared by dissolving the sugar in pure water, the fruit is immersed in it and left at rest for a certain period in large earthernware pans, glazed inside, and having a capacity of about eight gallons.

The syrup penetrates the pulp, and gradually withdraws and replaces the remaining fruity juice, which, as it exudes and mingles with the transparent liquid, produces a certain filmy, or clouded appearance, which marks the commencement of fermentation. When this has reached a certain stage, the vessel containing the syrup and fruit is placed over the fire and heated to 212 degrees Fahrenheit. This corrects the fermentation and raises all impurities to the surface, whence, if necessary, they can be removed by skimming. If the syrup is of proper density, this process of impregnating the fruit with sugar will be complete in about six weeks, during which time it is usually necessary to perform this heating process, as above described, three times. The impregnation of the fruit with sugar being thus complete, it is taken out, washed in pure water to remove the flaky particles that adhere, and is then submitted to one of two finishing processes, as follows:

If the fruit is to be "glacéd," that is, covered with an ice or transparent coating, it is dipped in a thick, viscid syrup of sugar and left to dry and harden rapidly in the open air. If it is to be "crystallized," it is dipped into the same syrup, but is then cooled and dried slowly in a kiln or chamber warmed to a temperature of 90 degrees Fahrenheit.

This slow cooling causes the thick syrup with which the fruit is covered to crystallize and assume the usual granulated appearance. The work is now finished. If properly done, the fruit thus preserved will bear transportation to any climate, and will keep firm and unchanged for years. It is packed in light wooden or cardboard boxes, and may be shipped in cases containing several hundred pounds each.

Uses of the Spent Syrup.

During the process of impregnating the fruit with sugar, the syrup in which it is immersed is gradually deteriorated by losing its sugar and absorbing the juices of the fruit. It is finally utilized in the preparation of "confiture d'Apt," which is made of the soft, over-cooked, and irregular pieces of fruits of all kinds mixed in irregular proportion and preserved in the spent syrup, which is boiled down to the required consistency. This branch of manufacture, like many others, gives opportunities for sharp practice, particularly in the use of glucose in place of pure sugar, and of certain chemicals, notably salicylic acid, which there is reason to believe is employed to some extent by certain confectioners to shorten, and thereby cheapen, the process of preservation.

Salicine, the basis of this acid, is a flaky substance derived from the bark of certain species of willow. It is used in medicine as a febrifuge, two grains per day being regarded a safe allowance for adults. Salicylic acid is made by the action of sulphuric acid, bichromate of potash, and water upon salicine. In just what degree salicylic acid is deleterious to health I am not informed, but it is the opinion of good judges that its use in the preservation of fruits and wines should be prohibited by law. It is a powerful antiseptic, and is for this reason used in the mixing of wines, and, as already indicated, in the fruit crystallizing process, to arrest and prevent the acetous fermentation of the juice, which would otherwise spoil fruits which have been imperfectly prepared.

As has been shown above, the process of eliminating the natural juices of fruit and replacing them with sugar by immersion in syrup requires about six weeks. By the use of salicylic acid, which penetrates the pulp and exerts upon the juices an antiseptic influence which prevents fermentation, this process can be reduced to a few days only. Time, labor, and sugar are thereby saved, but naturally at the expense of quality in the finished product.

Cost and Market Values.

The net cost of preserving fruit by this process varies, of course, with the price of sugar, labor, interest on investment, etc.; and this is moreover a point upon which confectioners are not disposed to be communicative.

But with the facts at our disposal, the question of costs can be closely approximated. Sugar costs here this season, as already stated, 9.65 cents per pound, and fruit in condition for crystallizing, on an average 8 cents per pound. The labor of women to pare, stone, and otherwise prepare the fruit costs 50 cents per day; that of men sufficiently skilled in the processes of scalding and preserving, to work under the direction of a foreman, commands from 80 cents to $1 per day. In most establishments the proprietor or a member of the firm is the superintendent, who personally directs the work.

Most leading confectioners and caterers of Marseilles manufacture their own crystallized and "glacé" fruits, which they sell at retail from 50 to 75 cents per pound.

The wholesale trade prices of quantities for export are much less, as will be shown by the following exhibit of the average values, as declared for export to the United States and other countries, of the several fruits during the season of 1884, which was a year of abundant fruit harvest, and the present summer and autumn, when all fresh fruits, except cherries and figs, have been more expensive by reason of a short and inferior supply:

Articles.	1884.	1885.
	Per lb.	Per lb.
Apricots	$0 27½	$0 29
Chinois—Green	24½	23
Ripe	24	25½
Cherries	23	23
Figs (Marseilles)	21	20
Pears—Red	24	25½
White	24	24
Plums—Green Gage	24½	29
Yellow, mirabelles	25	26
Pineapples (from West Indies)	33	33
Citron	13	22
Melons	24½	25½
Strawberries	29	29
Mixed fruits	25½	30

This would give an average of about 24 cents per pound for 1884, and 26 cents for 1885.

Deduct from these values, say 20 per cent for manufacturers' profit, and we reach from 19 to 20 cents per pound as the average cost of production.

Add to these values the cost of importation and a duty of 35 per cent ad valorem, and the crystallized fruits of Provence become a rather expensive sweetmeat to American consumers.

The Industry in the United States.

But there would seem to be no good reason why this dainty and profitable industry could not be established with immediate and complete success in the United States, where most ordinary fruits grow in profuse abundance and with finer flavor than is developed by the same varieties in any part of Europe. Sugar is equally cheap, and fuel far less expensive in our country than it is here. From the foregoing account it will be seen that the process of crystallizing fruits, as well as the requisite apparatus, are exceedingly plain and simple. But the most profusely furnished kitchen, abundant raw material, and a library of books on cookery will not enable a novice to prepare a well cooked dinner.

There is so much in the art of crystallizing fruit which can only be learned by experience, that in order to begin the experiment with certainty of success, American pioneers in this manufacture should employ competent French workmen to superintend the construction of their plant, instruct the operatives, and superintend the whole process of preserving and packing during the infancy of the business.

The extent to which the crystallized fruits of this country are imported by the United States would seem to indicate that here is an opportunity for a new and profitable enterprise.

FRANK H. MASON,
Consul, Marseilles.

COGNAC.

REPORT BY CONSUL IRISH.

I have extended my inquiries, as far as practicable, for this portion of France, and am enabled to state that the actual processes of crystallizing fruits have been generally abandoned throughout the country, on account of the expense attending thereon, and the general scarcity and usually high price of fruit.

However, there are, in all the towns of this region, such as Cognac, Angoulême, Saintes, Rochefort, La Rochelle, and Limoges, persons who are familiar with the business, who deal in crystallized fruit, and who have formerly engaged in its manufacture. The testimony on the subject is to the effect that the process of crystallization is now largely and almost entirely confined to a few points, namely: Clermont-Ferrand, in the Department of Puy-de-Dome, in the Consular District of St. Etienne, and Carcassonne, Department of Aude, in the extreme south of France, and in the bounds of the Cette agency of Marseilles.

A reasonable amount of manufacture is done at Paris, and also at Bar-le-Duc, Department of Meuse, where the production is chiefly confined to the preserving of currants, gooseberries, and such like fruit.

Clermont-Ferrand is the most important place for this industry in France, and as fruit is usually abundant and cheap in that locality, they are enabled to furnish the dealers throughout all this region to much better advantage than the dealers themselves can manufacture it.

As a consequence of the confinement of the work to localities beyond my bounds, it will be seen that I have not the data for its cost and extent of production.

Neither are the manufacturers usually disposed to furnish detailed information concerning their business, and many obstacles lie in the way of an investigation.

I am enabled, however, to furnish a tolerably clear statement of the various processes of the work, which, as a whole, is quite uniformly practical whenever the labor is performed.

Whitening Fruits.

Much precaution is necessary to be taken to well preserve the fruit, whether it be dry or watery, in order to obtain good results.

Success depends largely upon the first act of bleaçhing. The bleaching, or whitening, of the fruit must be regulated according to the quality and maturity of it; the water must not boil; must simmer only.

It is well to choose each kind of fruit a few days before being ripe; it should be hard or firm and gathered in dry weather in the morning, and whitened as much as possible the same day, for if too ripe it will fall in marmalade; if not enough it cannot be properly preserved, the pores will become closed, and the sugar cannot penetrate. The fruit will become hard, acid, black, and moldy. It is necessary to place the fruit in a considerable quantity of water to whiten it, that the water cover it at least eight inches, in order that there be no necessity to increase the quantity during the process. In such a case added water should be of the same temperature. Cover the fruit with an osier screen or linen cloth, and put about four inches from the bottom of the vessel a copper colander, to prevent injury from the fire. Stir the fruit from time to time lightly with a skimmer, to aid the riper portions to rise. Usually the fruit is whitened with the naked fire, but it is much easier to do it with steam, because in that case it is not exposed to the danger of scorching, and the degree of heat for the various kinds of fruit is easier regulated.

Each kind of fruit is whitened in a different manner. Stone fruit is placed in cold water over a slow fire, and removed with a skimmer as soon as it rises to the top of the water. The condition of the cooking is ascertained by the use of a pin, which must easily penetrate, or by softly pressing with the fingers. When it is found to be sufficiently soft, it is taken out and put in cold water. If there is a great quantity of fruit to be whitened, the same water may be used again, especially for plums and green fruit.

Plums that are whitened in the first water not being so nice and transparent as those whitened in the second, the poorest, and ripest, and ill turned may be whitened first, to acidulate the water. Some confectioners employ lemon juice, virjuice, pyroligenous acid, alum, marine salt, epsom salt, etc., to preserve the whiteness of the fruit, and blue vitriol, vinegar, or salt, to turn it green. It is dangerous, however, to use the blue vitriol—too great a quantity causing the water to turn bluish, the fruit will then become black. If used, put not more than three grains to a quart of water; and when the fruit is whitened, put it in water for twenty-four hours, changing four or five times.

To be assured the water or fruit does not contain any part of the

vitriol, plunge a well polished bar of iron into the water; if it is not covered with a copper tint, there is no danger.

When plums or other fruit are to be whitened, if the water is to be used again, let it cool before using until it becomes lukewarm, and leave the fruit in it awhile before heating; this is why the use of steam is so helpful.

Fruit with a tough skin requires longer to whiten, and time according to its quality; hence, the following notices of the time required to preserve each kind of fruit.

Sugaring Fruit.

After the whitening process is completed, great care is still required to properly preserve them in sugar. If the fruit is too firm or hard, or not ripe enough, on being removed from the whitening process it must be put in sugar reduced to a syrup of 23 degrees; the water contained in the fruit will be eliminated, and the syrup reduced to 20 degrees; it will be necessary the next day, for the first operation, to increase it to 25 degrees. Cover the fruit and boil it, pour it out gently into an earthen dish, and place it in the cellar in a cool and dry spot to avoid fermenting. Continue cooking it from day to day, making it one or two degrees thicker. Cover when boiling.

Ordinarily this process is repeated from five to eight times, thickening to 36 degrees or more, according to the maturity of the fruit. If the fruit is soft or too ripe, it will be necessary to cook the sugar more to harden it, and preserve it from falling into marmalade. Reduce the sugar to 28 degrees for the first shape or condition, increasing 2 degrees each day for each shape. It is sometimes necessary to give two shapes each day, morning and evening. In that case increase the sugar only 1 degree each time, and only simmer the fruit; afterwards put it in the cellar. If it is desired to preserve the fruit very clear and white, it is necessary to change the syrup in the middle of the shape. In such case it is necessary to thicken the syrup with apple jelly or glucose, to prevent its candying. When the fruit is sufficiently preserved, it is left in a cool and dry place from eight to fifteen days, in order that all the water may escape and it become impregnated with the sugar.

It is necessary that the fruit be well drained at each shape or stage of the process, because if reduced syrup remains at the bottom of the vessel into which the fruit has been poured, and a covered boiling or simmering has been neglected, it will contribute to its fermentation.

A spigot at the base of the vessel for the purpose of draining the syrup is very useful in the case of apricots, chestnuts, strawberries, raspberries, and all tender fruit. The quantity of sugar necessary to preserve each sort of fruit is not indicated, as the fruit will take only the amount of syrup necessary for it; it is only necessary that it bathes in the syrup.

Preparing Particular Fruits.

I present herewith instructions for preserving a number of the more important kinds of fruit:

Apricots, whole.—Choose the white apricots, from high trees, or grown in a garden, along the wall. They will be recognized in opening by the meat forming species of rays around the stone.

It is necessary to take them some days before their maturity, when they begin to turn yellow, and the stone is easily detached, and they are firm.

Make a little incision at the head with the point of a knife. Hold the fruit in the left hand with the thumb and forefinger; then pushing the knife at the place of the stem, the stone goes out at the top or head. Proportion the apricots in water slightly alumed, or acidulated with lemon juice. Prick them in the green parts which are not ripe enough; then whiten them on a slow fire; stir them from time to time to aid the ripest to rise to the surface; try them on the skimmer with the fingers or a pin, and put them in fresh water as soon as whitened. When they have become cooled, after having changed the water several times, put them in sugar warmed to 20 degrees, and make them simmer or slightly boil, if they are not too ripe. The next day put them in sugar at 22 degrees, boil them, covered, if the fruit is firm, or simmer them if the fruit is tender; continue thus each day for five or six days or processes, increasing 2 degrees each time until 36 degrees; then let them remain for fifteen days, as heretofore indicated.

When the fruits are a little large, turn them with a thin and suitable knife, that the sides may correspond; with a toothed knife, the sides are better and neater. Cherries, oranges, nuts, pears, etc., are turned in the same manner.

Stuffed Apricots.—Take whole, preserved apricots, and introduce in each a plum or other small preserved fruit separated from the stone, which replace by lemon or lime.

They are equally stuffed with the marmalade of apricots, pineapples, strawberries, apple jelly, currants, cherries, raspberries, etc., and a peeled almond is put in the middle.

Apricots in Quarters.—Choose apricots already yellow, without being ripe, firm, and with the stone easily detached. Peel them, or turn them, and prick them lightly with a pin, and immediately throw them in fresh fountain water lightly alumed. Whiten them and put them in the syrup like the whole ones. When they are preserved, drain them, put them in a stewing dish with syrup at 20 degrees, and add the juice of a fine orange. The apricots are iced and candied, drained, and placed with preserved fruit in boxes. Increase the syrup at each process, so that the fruit is bathed in it.

Pineapples.—Choose the pineapples before they are entirely ripe, remove with care the first pellicle, leaving half of the middle of the crown; prick them with a large needle to the heart in several places. Whiten and preserve them like apricots.

Cherries.—Take fine cherries with considerable acidity, take off the stems, push out the stones with a quill, and place them reversed side by side on a strainer. Afterwards put them in an earthen dish in layers, with equal parts of powdered sugar, until the next day. It is necessary to decant them several times to dissolve the sugar. Heat them slowly and proceed as with syrup.

Quinces in Quarters.—Choose quinces of a fine yellow, and well ripe and sound. Take off the down with a linen cloth, prick them to the heart with a large needle, put them in a proportional quantity of alumed water, place them afterwards over a quick fire, boil for time, and when tender throw them into fresh fountain or river water in preference to well water (as such contains less calcareous salt, and is softer). Fountain water is preferable for preserving all fruit, especially white fruit. Peel them, and take out the cores, cutting them in equal quarters; put them again in alumed water, and continue whitening them until the head of a pin passes easily through the quarters and the hole closes up again. Quinces are also whitened in the following manner: the fruit is just peeled, and a lemon rubbed over each slice to prevent its becoming red; then put in alumed or acidulated water, then they are whitened. The former process is preferable. They are preserved like apricots, having care to cover them with a white linen cloth at the surface of the water, and to cover each vessel into which they are poured with linen or white paper, to hinder the fruit from reddening. It is necessary to take these precautions for all white fruit. When it happens that water reddens in whitening them, it is necessary to change the alumed or acidulated water.

Lemons.—Choose fine lemons well united, turn them, make a hole with a punch at the right of the stem, put them successively in fresh water. Whiten them, empty them like oranges, preserve them, and ice them the same.

Quarters of Lemons.—Take fine lemons, well ripened, united, and without spots; separate the largest part of the white, after having cut them in equal quarters. Whiten these skins like citrons, and preserve them and ice them the same.

Citrons.—Choose fine citrons uniformly ripened. Test them with a piece of glass to raise only the surface of the rind. Make a hole with a punch a little larger than for lemons. Whiten them with much water. When they are half whitened, empty them with a coffee spoon, put them in fresh water, and finish them and whiten them like lemons, and preserve them the same. Citrons in quarters are emptied only when they are whitened. Leave them forty-eight hours in fresh water, changing it two or three times a day to remove the bitterness of the rind.

Raspberries.—Choose fine red raspberries, not too ripe, that you examine carefully. Put them in an earthen dish, about nine pounds in each; cook with an equal part of sugar *au soufflé*; empty, decanting four or five times during an hour, into a similar dish; put them on a slow fire, bringing them to a boil again; put in the cellar until the next day, draining slowly so as not to crush them; and cook in sugar at 28 degrees, covered while boiling. The next day cook them at 30 degrees, the third day at 32 degrees, afterwards drain them so as to dry and candy them. I need not specify their numerous uses.

Strawberries.—Choose them firm, without being quite ripe, and preserve them the same as raspberries and cherries.

Oranges.—Choose very fine oranges, very firm, and with a thick skin. Turn them, making all sorts of designs, and put them in fresh water. Whiten them, and empty like lemons and citrons. They are preserved and iced the same.

Oranges in Quarters.—Choose similar oranges. Make four separations in the orange without detaching the quarters. Whiten as heretofore shown, and when they are well preserved divide the quarters for the various uses. The skins and peels are preserved and iced the same, and are used to perfume sweetmeats, etc.

Plums.—Choose fine fresh plums, not too ripe, but commencing to turn yellow. The plums of Metz are superior to all others in France for preserves. They are very transparent, and once preserved have a very delicious taste. Prick them to the stone with five or six pins fastened in a cork. Put them in a proportional quantity of fresh water lightly alumed. Let me here refer to a former statement about using water more than once in whitening plums. Care must be taken to put the fruit only in lukewarm water to commence to whiten it, and to leave it in some minutes before increasing the heat. The plums are whitened and preserved the same as apricots.

Pears.—Choose fine pears, like the butter pears of England, or Rheims, or Bergamots, and when not too ripe, when the pips are black, and when in paring them they are white under the skin. Put them, with a good deal of water, on a quick fire, or with steam, until they are softened, then remove them and put them in fresh, cold water. Pare them as lightly and promptly as possible, prick them from the head to the core, cut and scrape the end of the stem, and throw them into a quantity of fresh water, alumed and acidulated. Put thém again on the fire, cooking them until the head of a pin enters easily, and the hole closes on withdrawing it; then put them again into fresh water, lightly alumed or sharpened with lemon juice. Preserve them with the same precautions as quinces and apricots. As the pears are easily candied, the sugar must be thickened with apple jelly or glucose.

Peaches.—Choose fine peaches, before their maturity, and quite firm; whiten them and preserve them whole, or in quarters, like apricots, being careful not to boil them, for it is a very tender fruit and liable to fall into marmalade.

Green Gages.—Take Green Gages of a good size without being ripe or colored, of a fine green rind, firm, the stone being detached easily. Cut the end of the stems, and prick them in divers places, notably near the stem, with a little bodkin. Put them in a basin full of water on the fire, or with steam, so that they may have ample room. As soon as they become yellow, remove them from the fire, and throw in a pinch of salt, vinegar, and spinach, or verjuice. Blue vitriol is also employed, but in small quantity; to make them green again let them remain quiet for some hours, then put them on a slow fire without boiling, stirring them from time to time until they again become green; then increase the heat, and as they rise to the top of the water, remove them and put them in fresh water, removing it several times until they become thoroughly coọl. They are preserved with sugar like other plums.

Chestnuts.—Which grow very large in this country, and are as much sought for as an article of food. Take the fine chestnuts of Lyons or Lucques, rend off the outside with the point of a knife, being careful not to touch the meats, and put them in a proportional quantity of fresh water. When they are all prepared, put them on a quick fire, or with steam, with a large quantity of water. Boil them until the skin can be removed, and they become tender, of which assure yourself with a pin; then remove them from the fire, and change the warm water, diluting the second water with a little flour to preserve the whiteness of the chestnuts. Peel them as promptly as possible to prevent their becoming too tender, and also not to break them, for this fruit is one of the most difficult to preserve, and all possible precautions must be taken. Put them in a proportional quantity of hot sugar reduced to 20 degrees; keep them warm over a slow fire, covering each dish with linen or white paper. The dishes must be provided with faucets to drain them more easily. Proceed to preserve them with the same care as with apricots; they may be iced with vanilla. Some confectioners do not give them the *shape* or *fashion* for fear of spoiling them, for they separate easily at the least contact with too strong heat. They keep them continually warm in a drying stove or slow oven. With steam or a hot water bath, they decant them from time to time, or stir them; the syrup can be reduced to 32 degrees. This means is very difficult, and only a small quantity can be made at a time.

Iced Fruits.

The preserved fruits are iced to dry them. They are drained, then passed through lukewarm water to wash them, then put an hour or two in a drying stove in an earthen dish. Sugar cooked to the grade *au petit soufflé* is put with them, and they are made to take a covered boiling, are skimmed, the basin taken from the fire, and placed on a table in an inclining position, where the sugar is massed on the border of the basin with a spatula. When the sugar commences to whiten, turn one or several of the fruits in the whitened portion, remove them with a fork, and spread them on a grate or strainer placed over a dish or mold to candy.

When the fruit is small, and the sugar commences to grain, mix the whole together, raise the fruit quickly with a skimmer, and put it on a

strainer. When the fruits are soft it is necessary to cook a little harder, and mass the sugar more than for hard or dry fruits and rinds.

This ice is now kept for use, and when wanted a little sugar is added each time. When thick or gelatinous, it is cooked and massed more, or replaced.

Candied Fruits.

Drain the preserved fruits, wash them in lukewarm water, and put them on a strainer on the stove to dry. When they are dry put them side by side, and put them between two strainers made for the purpose, and place them thus in a mold to candy.

Take sugar cooked *au petit soufflé* at 36 degrees to 37 degrees, and pour it slowly over the fruits from above, and then place the mold in a drying stove, heat to 40 degrees, drain when sufficiently candied, ordinarily at the end of five or six hours.

Fruits that are dry and firm are also candied cold; the candy is finer and less subject to mass; in that case the sugar is cooked 1 degree or 2 degrees less, is put to candy at night and drained the next morning.

Sugars.

I now, perhaps, have sufficiently presented the processes required by my instructions, but it seems important, to make matters clear, that something be said concerning the various forms of preparations of sugar that are used in the business.

Only clarified sugar is used, and this is reduced to syrups of various densities. The degree of density is ascertained by a *pèse syrup*, an aerometer invented by Baumé.

The first condition of cooking which I shall mention is called *la nappé*, and the sugar weighs 20 degrees. When, in dipping the skimmer into boiling sugar, after a turn of the hand the syrup spreads along the skimmer, it has reached this stage.

Petit lissé.—The sugar weighs 25 degrees. Some boilings after *la nappé*, pass the forefinger on the skimmer charged with syrup, and apply it against the thumb. If in spreading these two fingers you see a little thread, which breaks immediately, leaving a drop on the finger, you have *petit lissé*.

Grand lissé.—The sugar weighs 30 degrees. When the thread has more consistency, and spreads more, you have *grand lissé*.

Petit perlé.—The sugar weighs 33 degrees.

Grand perlé.—The sugar weighs 34 degrees and 35 degrees. If at last in spreading the two fingers the thread sustains itself without breaking, you have the *grand perlé*. The attentive workman will distinguish these two cookings by the aspect of the liquid. It produces large, high, round bubbles, going out from the boiling in the form of pearls.

Petit soufflé.—The sugar weighs 37 degrees. It will be recognized when, in blowing through the holes of the skimmer after it has been shaken, the liquid forms little bubbles on the side opposite, which lightly detach. This is the *petit soufflé* employed in icing fruit.

Grand soufflé.—The sugar weighs 38 degrees. After some boilings operate as in *petit soufflé*. If the bubbles are larger, resembling soap bubbles, and maintaining themselves a moment, it is the *grand soufflé*. Or dip your finger in fresh water, plunge it in the sugar, and dip it again in the water, if there remains a little compact sugar at the end of your finger, you have the same thing.

The same means are employed for the cooking of *gros candi*.

Petit boulé.—The sugar weighs 39 degrees. Dip your finger in fresh water, then in the boiling sugar, and then again in the water. If it forms a soft ball which one can turn in the fingers, you have the cooking for bon-bons with liquors.

Grand boulé.—The sugar weighs 40 degrees. After some boilings more renew the preceding operation. If the ball is larger and harder, you have the cooking for preserves which are not clear.

Petit cassé.—After some boilings operate as before. If in cooling the sugar it breaks, if it attaches to the teeth, it is a *petit cassé*.

After the *grand boulé* the degree of the sugar is no more observed. It is then the cooking of the twisted sugars, or *sucrestors*.

Grand cassé.—When, after being further cooked, the sugar produces a little simmering in water, and adheres no longer to the teeth, it is a *grand cassé*. This is the cooking of

barley sugar, caramels, burnt almonds, etc. An experienced workman will readily recognize it by the crackling which the sugar makes in the fingers.

J. E. IRISH,
Consul, Cognac.

RHEIMS.

REPORT BY CONSUL FRISBIE.

While crystallized fruits (*fruits glacés*) are kept on sale by all first class grocers and confectioners, and quite extensively used by the people, they are not manufactured to any extent in this district, for the principal reason that the fruit grown here is not of sufficient variety, quality, and quantity for the purpose, and, by reason of its scarcity, it usually commands too high a price to make the business profitable. I have found that the industry of manufacturing crystallized fruits, and other preserving methods, is carried on in southern France, the great center of the industry being at Clermont-Ferrand, in the Department of Puy-de-Dome, about one hundred miles west of Lyons, which is the greatest fruit-producing section of France, and where fruit of many kinds is nearly always plentiful and of the best quality. The dealers in this section usually purchase their crystallized and other preserved fruits from the wholesale houses of Paris, who receive it in large quantities from the section named, and in some considerable quantities from Nice, where it is also quite largely manufactured. It is said that this fruit is not so finely and nicely made at any other place in France as at Clermont-Ferrand and at Nice. There is at Rheims, however, an occasional confectioner of the first class, who finds himself in a position to advantageously manufacture his own fruits, but this is always done on a small scale and only for the needs of his local customers, and never for wholesale nor for export, and which my information teaches me they manufacture according to the following methods, and which are said to be substantially the same as that employed in the large establishments in the south of France.

Crystallized Fruits.

Begin the operation by dipping the fruit into hot, melted sugar for a moment; let it drain and dry. Then wash it lightly in lukewarm water, after which put it into earthenware pans or dishes and place it in a warm (not hot) oven for a couple of hours. Cook some sugar over a slow fire in a copper dish at 105 degrees of heat; put the fruit in the boiling sugar for a few seconds; skim; remove the dish from the fire and place it on a table in an inclined position, and collect the sugar on the side with a spatula. When the sugar begins to whiten roll the fruit in it, one or two at a time; remove it with a fork and place it on galvanized or tinned-wire sieves or grates, over earthenware dishes or candy molds. When the fruit is small, as soon as the sugar begins to granulate mix the whole, fruit and sugar, rapidly together and remove quickly with a coarse skimmer, placing the fruit on a wire sieve, as above described. If the fruit is soft, cook it a little more, and stir the sugar longer with the spatula than if it be hard, dry, or of the rinds.

Keep the glazing (sugar) for future use, and, if necessary, renew it by adding more sugar. Should the sugar become pasty, cook and stir it longer, or, better still, replace it with fresh glazing.

Candied Fruits.

First, dip the fruit in hot, melted sugar for a moment, let it drain and dry, after which wash it lightly in lukewarm water; then place it on a sieve to dry in a warm (not hot) oven. When it is dry, cook some sugar over a slow fire to 95 degrees or 100 degrees of heat. Place the fruit side by side between two galvanized-wire sieves or grates in a candy mold; pour the sugar carefully over the fruit and then place the molds in an oven heated to 105 degrees. When the fruit is sufficiently candied, which is usually accomplished in five or six hours, remove and let the fruit drain and dry.

Fruit that is hard or dry may be candied by the cold method, the candy being finer and less liable to granulate. Cook the glazing to between 95 degrees and 100 degrees of heat. Place the fruit in the glazing in the evening and remove it the following morning, when it is allowed to drip and dry.

Carameled Fruit.

Begin by preparing each kind of fruit, according to its nature, to be dipped into the caramel, a substance obtained as follows: Cook about two pounds of clarified sugar, which is preferable to melted sugar, to which add a spoonful of glucose to prevent its granulating, and cook it until it becomes hard and brittle when placed in cold water. Place an earthen or copper dish in an inclined position over a slow fire or over hot coals lightly covered with cinders or ashes so that the sugar does not get cool. Dip the fruit in the sugar and then place it on a sieve or hang it on strings over an oiled marble slab; for small fruit, on wire sieves or grates made for the purpose, and for large fruit, such as oranges, chestnuts, etc., simply place them on the marble.

If the fruit has been prepared on strings, cut the strings and place the carameled fruit on sieves and put it away in a dry place. If the fruit has been done on skewers, especially oranges, remove the skewers before the caramel is completely cold, as otherwise the caramel gets broken and the juice of the fruit escapes. When removed in proper time the hole made in the fruit by the skewer is easily closed up by the warm caramel.

Fruit should only be carameled a few minutes before serving, so as to be nice, fine, and fresh. Carameled fruit can be either served up in fancy structures and forms, or separately. When carameling fruit two or more persons should always be engaged in the operation, as the caramel should be kept hot and never allowed to cool, as if it is reheated it will granulate and redden. To caramel fruit, wooden skewers, string, or galvanized or tinned wire may be used.

In carameling cherries there are three things to be considered, viz.: (1) If fresh, they must be very fresh and sound, and have the stems cut short, that is, about half length; (2) If the cherries have been preserved they must be dried before the operation; (3) If brandy cherries are used they must be allowed to drip, and left a few minutes in a warm oven. They are either tied together or fastened on skewers, then dipped and hung up to dry.

Chestnuts.—Roast the chestnuts slowly so as not to scorch them; remove the shell and inner husk. Put them on skewers and dip them in the caramel. In removing them give them a twirl, so as to spread the caramel evenly over them, and lay them on a slightly oiled marble slab.

Oranges.—Choose the finest and firmest fruit, remove the peel, divide into quarters, remove all the white with a knife, taking care not to cut the skin, as the juice would come out and dissolve the caramel. Put them on skewers on a sieve, and place them in a warm (not hot) oven, to be slightly dried before dipping. Finish as with chestnuts. Oranges should be skewered through the center so as to prevent the juice from running when the skewer is withdrawn.

Preserved Fruits.—All kinds of preserved fruits, such as apricots, small oranges, plums, nuts, pears, dates, prunes, etc., can be carameled by following the foregoing instructions. Only care should be taken that the fruit be first washed in lukewarm water to remove the syrup, and then dried in a warm oven.

Grapes.—Fresh or dry Malaga grapes are frequently used, and grapes of the country in their season. Several grapes are fastened on galvanized wire, and the bunches thus formed are fastened on a wooden skewer; they are then dipped into the caramel, and then placed on small wire sieves, of which the meshes are made of proper size to hold the grapes, and placed as usual above a marble slab.

Small fruits, such as currants, raspberries, strawberries, almonds, filberts, hazelnuts, etc., can be carameled, but care should be taken that the fruit be separated when removed from the sugar.

JOHN L. FRISBIE,
Consul, Rheims.

BORDEAUX.

REPORT BY CONSUL ROOSEVELT.

Having carefully examined the methods employed in crystallizing fruits, I am enabled to report as follows:

All fruits indigenous to France, and a few select fruits from other countries, as also several species of soft-shell nuts, are employed.

The kettles used are generally of copper (much broader than deep, to prevent crushing the fruit), provided with a wire frame placed one or two inches from the bottom to protect the fruit from scorching. When ready for use, they are three fourths filled with water, which is heated to boiling point (95 degrees Centigrade), and covered by a towel or straw cover.

The fruit should be gathered several days before maturity; and, if possible, early in the morning of a dry day. The first important step is the bleaching, or, more properly speaking, the parboiling of such fruits as are to be subjected to this preliminary process. The fruit should be picked and bleached the same day to obtain best results. The pits are carefully removed, and the fruit plunged into very cold water before being transferred to the kettle. During the process of boiling, the fruit is occasionally gently stirred, so that each separate piece may be equally cooked. When the fruit begins to settle at the bottom of the kettle the fire is reduced for ten minutes, then gradually increased until the fruit again rises to the surface, and becomes sufficiently tender to be punctured with a straw. They are then carefully removed from the kettle with a skimmer, and dropped into very cold water, which is renewed several times, or until they are thoroughly cold; they are then placed upon wire frames to dry. The boiling should be accomplished quickly, so as to submit the fruit to as rapid and sudden change of

temperature as possible. The boiling is generally done over an open fire, but the most satisfactory results are obtained when steam is employed, as it is an easier matter to regulate the heat from steam necessary to the different kinds of fruit.

Great care must be taken in the first boiling, since the fruit, if over done, falls to pieces, and if under done the pores are compressed, preventing a thorough permeation of the sugar, and in consequence the fruit becomes tough, dark in color, and soon grows moldy. When the same water is used a second time for the purpose of boiling, it is thoroughly cooled before receiving the fresh fruit. It is then slowly heated, the temperature being maintained at a low point for a considerable time.

When the fruits are not sufficiently soft after the first boiling, they are put into a hot syrup (invariably made of cane sugar) of 25 degrees of density; the water remaining in the fruit is absorbed by the syrup, and is gradually reduced. After the preliminary boiling in water the fruit is submitted to the syrup daily for five or ten days, or until the sugar has thoroughly penetrated the pores. After each boiling the fruit is carefully removed from the syrup and put into a cool place to dry. The syrup for the first boiling is always 25 degrees of density, and is increased 2 degrees each day until it reaches 36 degrees, excepting in cases where it is necessary to submit the fruit to the syrup twice in the same day, then it is only increased one degree, and is not allowed to boil, but only to scald the fruit.

Fruits are crystallized with and without rind, whole, in halves, and in quarters. Pears, apples, quinces, and oranges are generally crystallized peeled. To retain the delicate coloring in such fruit as the apricot, pear, peach, and chestnut, it is necessary to add to every hectoliter of cold water forty or fifty grams of pulverized alum.

Some confectioners employ lemon juice, verjuice, salt, sugar of milk, and epsom salts, to preserve the whiteness of the fruit after boiling, and sulphate of copper, vinegar, or salt, to retain the green color natural to certain fruits.

When the crystallized fruit is destined for warm countries, it receives additional cooking. The fruit, when crystallized, is packed in boxes containing a quarter of a pound to two pounds each.

There are several establishments in Bordeaux devoted to the crystallization of fruits, the most important of which is that of Alexander Droz & Co., to whom I am under obligations for much valuable information. Their average annual sale of crystallized fruits is one hundred and sixty thousand pounds, the half of which is consumed in France. Their annual exportation of cherries alone to England and Russia is twenty-four thousand pounds.

It is estimated that very nearly seven hundred thousand pounds of fruit is crystallized at Bordeaux annually. The average cost per pound (not including the price of the fruit) to the producer is 15 cents, or $15 per hundred weight. The fruits in greatest demand on this market are apricots, cherries, and chestnuts. The separate preparation for each I give in full below.

Apricots.—The apricots should be picked several days before maturity. An incision is made by a knife at the head, and the pit gently forced out; the unripe parts are lightly pricked, and the fruit is then plunged into very cold water containing a little alum or lemon juice. The water is changed frequently before the fruit is transferred to hot syrup of 20

degrees of density, preparatory to boiling. After boiling, the fruit is taken from the syrup and removed to a cool place until the next day. This process is followed for five or six days, each day increasing the density of the syrup 2 degrees, until it reaches 36 degrees. The fruit is only permitted to boil after the first cooking if it continues too firm; if soft, it only simmers. The kettle containing the fruit is removed from the fire, and as the syrup begins to whiten, the fruit is carefully turned in the whitish parts, and then removed from the kettle and placed on a wire frame to dry.

Cherries.—Large cherries should be chosen. After the stems are removed the pits are taken out, the cherries are placed on a dish side by side, with the open side up, and covered with powdered sugar; layer after layer is thus formed until the dish is filled; it is then set aside until the next day. They are frequently stirred, and finally are slowly cooked and crystallized.

Chestnuts.—The large chestnuts of Lyons, France, or Lucques, Italy, are preferred. The outer shell is removed, care being taken not to bruise or break the nut. They are immediately put into cold water, from which they are transferred to a large kettle of boiling water, where they remain until they become tender; they are then taken from the boiling water, freed from the skin surrounding them, which is a delicate operation, and should be accomplished as quickly as possible, as the nut is liable to crumble, and in consequence is difficult to crystallize. Once peeled they are put into syrup of 20 degrees of density, and are kept hot over a slow fire. The kettle is covered with a towel or piece of white paper until the syrup begins to whiten. The kettle is then removed, and the same process followed as employed in crystallizing apricots.

GEO. W. ROOSEVELT,
Consul, Bordeaux.

NICE.

REPORT BY CONSUL HATHEWAY, OF NICE.

The art of fruit crystallization, as employed in France, is, in theory, a process by which certain fruits are preserved by withdrawing their juices which lead to fermentation, and substituting a thorough saturation of sugar.

The successful practice of the art depends largely on the judgment and experienced skill of the confectioner, for many conditions, independent of any formula, may operate in favor of or adversely to the desired results.

The nature of the soil from which the fruits have been produced must first be carefully considered. Confectioners here prefer, therefore, to select their fruits among those grown on a dry soil, as such are more palatable, damp land producing those too soft, or of an insufficient firmness of fiber to support the fabrication.

The process also is modified by the variety of fruit used, and its degree of hardness or ripeness; and the exact adaptation of the syrup thereto is also a requisite to complete success. For instance, pineapple demands a density of syrup of only 18 degrees, while other fruits of less consistency require, according to their kind, a syrup up to a maximum of 42 degrees.

Again, some fruit must receive a special preparation. Thus, cedars,

mandarin, and bitter oranges should be soaked first in a bath of sea water, often changed, which gives them consistency and removes a disagreeable flavor which renders them otherwise unfit for use.

All fruits produced here, apples excepted, can be crystallized, but the more "fat" the fruit the less easily the syrup penetrates into its pulp; thus, oranges admit of the process easily, but plums much less readily.

The oranges used for this purpose are gathered at times commencing when the fruit is hardly formed, and has simply the firmness and taste of fruit, and continuing until when nearly ripe and of full size it begins to be somewhat colored.

Process of Crystallizing Fruits.

The fruit is plunged into very hot water for a short period, or until it is white, or has become bleached.

It is then completely drained of water and placed in a syrup of white sugar which has been cooked until a small quantity separated between the thumb and forefinger forms slight filaments, and it is adapted in strength to the hardness, softness, and degree of ripeness of the fruit employed.

In this syrup the fruit remains until the mixture of juice and syrup shows a white clouded appearance, indicating the beginning of fermentation. The whole is then again subjected to heat and raised to the boiling point and then removed.

Such alternate fermentation and boiling is usually three times undergone, the fruit and syrup remaining together from two to five weeks, according to the kind and quality of the same.

Red copper boilers, with iron handles at the sides, and containing about twenty-five pounds, are used in the process.

Beaumé Aerometer.

The aerometer employed to show the amount of sugar which the water contains, is about eight inches in length, formed in ordinary glass, and in weight the same as the volume of water which, when used, it displaces.

One end of this is heavy, that it may stand upright in the liquid; the center has a chamber of rarified air, and the other extremity is a slender tube, on which is marked a graduating scale from the top toward the center of its length, and numbering 50 degrees. The rising of this tube above the liquid shows the density of the syrup.

One of the confections made from this preliminary process is styled "crystallize," the other "glacé."

To crystallize the fruit thus prepared (as in the foregoing description), it is taken from the syrup and dried in a room at a heat of 100 degrees Fahrenheit, when the sugar appears in small crystals on its surface. "Glacé" is prepared by removing the fruit from the syrup and allowing it to dry gradually. The sugar thus forms a glaze on the fruit, which gives it its name.

Production and Cost.

The quantity of fruits thus preserved in this consular district cannot be accurately determined, as there are no statistics of these products. The following data per year may, however, be received as nearly correct:

	Pounds.
Nice	90,000
Cannes	30,000
Mentone	15,000
Monaco	10,000
Whole amount	145,000

The expense of labor and sugar employed in the manufacture of them may be estimated as follows: (1) One and one half pounds of sugar to one pound of fruit, cost price of sugar, 14 cents; (2) Labor, per pound, of production, 5 cents; entire cost of sugar and labor, 19 cents.

One pound of crystallized fruit is sold here at the manufacturers' wholesale sales, at from 28 cents to 50 cents, according to its kind and quality.

I am indebted to the most experienced confectioners of this district for the foregoing information, and especially to the courtesy of M. Vogade, of Nice, and J. Negree, of Cannes.

ALBERT N. HATHEWAY,
Consul, Nice.

Consul Dufais, under date of November 9, 1885, sends the following translation of a letter of the Mayor of Clermont-Ferrand on the subject of crystallized fruits:

CLERMONT-FERRAND, November 7, 1885.

In answer to your letter, twenty-eighth last month, I have the honor to transmit to you the following information, which Mr. Dionis, confectioner, has been pleased to give me:

'The candying (glacéage) of fruit is an operation learned entirely by practice, and which is difficult to describe.

"When the fruit is well drained, boil the sugar briskly, put the drained fruit in it, cover up your pan (a large one) after one boiling, then withdraw it from the fire, work your sugar until entirely melted. Take the fruit out with a skimmer, put them on grid-irons in a drying stove. The price of candied fruit varies, according to quality and kind, from 2 to 4 francs per kilogram (about two and one quarter pounds)."

THE DATE PALM IN PERSIA.

REPORT BY MINISTER PRATT.

As a first result of my endeavors to obtain practical information on the subject of the date palm (*Phœnix dactilifera*), with a view to its introduction into the United States, and cultivation along our South Atlantic and Gulf Coast, and in Lower California, I have succeeded in gathering from Persian sources the following:

The date palm is found in countries situated within the zone of 16 and 30 degrees north and south latitude. Except, however, in rare instances it will bear no fruit in localities removed one hundred and twenty or one hundred and thirty-five miles from the sea.

There are two methods employed for propagating the date tree; one by setting the date stone, the other by transplanting the seedling (self-sown).

When it is desired to raise a plant from the stone of the date one per-

fectly ripe and faultless is selected, and both ends are either filed or scraped off with a knife until the inner kernel is laid bare. It is then planted in a mixture of gravel, sand, and camel manure. From twelve to forty days usually elapse before it makes its appearance above ground. It will then put forth long, narrow, thin, and tender leaves, somewhat the shape of a saddler's needle. From the fourth to the seventh year it produces nothing except long, rough, reed-like leaves. It is, however, possible that during this period the tree may, from its leaves, which resemble the shoots of the oleander, bring forth other leaves; but owners of palm gardens pluck off these in order to give the tree a graceful appearance. Under no circumstances, however, do they touch the leaves that shoot out from the crown of the tree. If its head is severed from its body the whole tree withers and dies. Each individual plant is either male or female.

When the tree has attained its full stature a flowering branch is cut from the male palm and applied to the half open flower bowl of the the female, thus giving it the fecundating principle, without which it cannot mature its fruit germs.

In no instance has it been recorded by botanists that one of these trees possessed in itself the different natures of male and female, and for this reason was it that the Arab savants classed the palm as the first of the vegetable kingdom and the last of the animal.

The height of the date palm varies from three to twelve meters. The tree itself will indicate the time of fruit bearing.

When it has arrived at its maturity it will cease its upward growth, and throw out from its head a large mass of long, broad, green leaves, which protect the neck from the glare and heat of the sun. The young seedlings must be removed from the foot of the parent tree in the month of January, and planted and reared according to the foregoing instructions.

In Persia the palm is grown near the ports on the Persian Gulf; also, in the hot districts of Kerman, Khûrzistan, and in the Oasis of Jandak.

E. SPENCER PRATT,
Teheran.

THE CITRON OF COMMERCE.

ITALY.

ROME.

REPORT BY CONSUL-GENERAL ALDEN.

The citron tree, or shrub, will grow wherever lemon or orange trees grow. It flourishes, however, only in a sandy soil and in the immediate neighborhood of the sea. It is most successful in sheltered situations on the shores of bays. As might therefore be expected, it is largely grown on the Ligurian Coast, which is sheltered by mountains from the north wind, and also in the southern Mediterranean provinces of Italy, and in Sicily. The French island of Corsica is probably the most prolific cit-

ron-producing district of the Mediterranean Basin. The present Corsican crop is estimated to be nearly five million five hundred and ten thousand pounds. Great care is needed in the cultivation of citron. The fruit when full grown is large and weighs from one to three pounds, and will, unless the branches are carefully propped up, either break them or bend them to the ground.

The average crop per acre of citron can hardly be ascertained, as the size of a crop depends upon so many conditions—such as the climate and soil. If we assume that each shrub or tree is planted three yards from every other, which by many growers is regarded as the best arrangement, we should have one thousand one hundred and ten shrubs to the hectare. If the average product of each shrub be assumed to be fourteen citrons, we should have a total product of fifteen thousand four hundred citrons to the hectare, equivalent to six thousand two hundred and thirty-one citrons to the acre; or, assuming the average weight of the fruit to be one and one half pounds, about nine thousand three hundred and forty-six pounds to the acre.

The cost of production varies so greatly in different localities and at different times, that no trustworthy and generally useful answer to the question of cost can be given. In the neighborhood of Genoa, however, it is roughly estimated at about $68 per acre.

More citron is imported into than is exported from Italy. The following table shows the imports and exports of citron for three years:

Year.	Imports—Pounds.	Exports—Pounds.
1882	3,896,701	513,019
1883	3,996,791	341,719
1884	2,743,454	262,572

The greater part of the imports of citron comes from France, and nearly all from the Island of Corsica.

Citron is chiefly prepared for the market at Leghorn, which is the most important citron port in the Mediterranean. The fruit is first put into a salt pickle, in which it is allowed to lie for three months. This pickling in the case of the Corsican fruit is done to a limited extent by the Corsican citron grower, but, as a rule, it is done after the Corsican fruit reaches Leghorn. The next process consists in dividing the fruit into halves and quarters, and packing them into sugar syrup. The syrup when first used is weak, but its strength is gradually increased by additions. Four weeks is the ordinary period during which the fruit remains packed in sugar, after which it is ready for the market.

The market price everywhere fluctuates greatly. During the present year the price at Leghorn has varied from $14 47 to $22 19 per fifty kilograms, or 110.20 pounds. To some extent, so it is said, these fluctuations were due to the speculative condition of the market in New York, where the price has varied greatly.

WILLIAM L. ALDEN,
Consul-General, Rome.

LEGHORN.

REPORT BY CONSUL SARTORI.

Cultivation.

The citrons which are subsequently converted into the candied citron of commerce are grown chiefly in Greece, Calabria, and the islands of Sicily and Corsica. Most of those which come to this port (Leghorn) are from Corsica, where, it is claimed, the finest qualities are produced. The citron tree is of the same family as the orange and lemon, and is propagated by cuttings, which begin to bear fruit the third year after being planted. It bears one crop of fruit yearly, which matures and is gathered during September and October. The trees are pruned every year, the branches being made to grow as much as possible in the shape of a hollow circle. They are also manured yearly, generally with stable dung. In summer it is essential that they should be kept well watered; otherwise, if there should be a drought, the trees suffer, and the fruit will drop off or will not attain its full size. The citron tree is more susceptible to damage from frost and cold winds than the orange or lemon, hence sheltered situations with a favorable exposure are sought for planting them, and hedges of brushwood disposed so as to protect them from the winds. The fruit resembles a huge lemon, and is often so large and heavy that it must be supported on the tree.

They are shipped to the factories for candying, sometimes in sacks, but usually in large hogsheads filled with brine. On being taken out of these hogsheads or sacks they are placed in tubs containing fresh brine and left for about a month. The brine is then renewed, and the fruit may remain in it until required for use, even for a period of four or five months.

Candying Citron.

When the citrons are to be candied they are taken out of these tubs and boiled in fresh water until sufficiently soft, which is ascertained by testing them with a fork. This usually takes about one and one quarter hours, and they are then cut into pieces, the seeds carefully removed, and they are immersed in cold water and left for twenty-four hours, and become a green color. After this they are placed in large earthen jars with hot syrup, which should entirely cover them, and remain about three weeks. During this time the proportion of sugar in the syrup is gradually increased. They are then put into boilers, with crystallized sugar dissolved in a little water, and cooked; then allowed to cool for twenty-four hours, and boiled again until they can absorb no more sugar, and then taken out of the boilers and placed on a wire netting to dry. They are now ready for packing, and placed in small wooden boxes containing about twenty-five pounds each, and these in their turn are packed in cases (half cases they are termed in the trade) which contain ten of them. The proportion of sugar used in the process of candying is 80 per cent—that is, eighty pounds of sugar to one hundred pounds of citron—and the kind used is generally Egyptian crystallized sugar, which costs at the factories 11.85 cents per pound. The Government allows a drawback at the above rate—that is, eighty pounds of sugar to one hundred pounds of fruit—on such as is subsequently exported. As the duty is 5.7 cents per pound, it being returned, makes

the cost of the sugar used in candying the fruit afterwards exported, 6.15 cents per pound.

There are nine factories for candying citrons in Leghorn, employing about three hundred men, and producing annually four million four hundred thousand pounds. In 1884 the United States took of these one million nine hundred and twenty-one thousand three hundred and forty-one pounds, valued at $214,652 23, and up to the present date in 1885 they have taken one million eight hundred and nineteen thousand seven hundred and sixty-four pounds, valued at $261,566 61, a decrease in the quantity and an increase in the valuation. The remainder is sent principally to Holland, for distribution through northern Europe and England.

The price paid by the merchants here varies according to the supply, 5¾ to 6¼ cents per pound being about the average cost of the fruit in brine at the factories.

The article is handled almost entirely by speculators, and the prices of the candied fruit show great variations. While during the early autumn the prices ranged from 16½ to 18½ cents, it can now readily be purchased for 13 cents per pound.

VICTOR A. SARTORI,
Consul, Leghorn.

MESSINA.

REPORT BY CONSUL JONES.

The Citron Tree.

Formerly in the Province of Messina the citron (*Citrus medica*) was extensively grown in hedges, as dividing lines between neighbors, but within the last twenty years this tree has been nearly exterminated in this vicinity by the diseases known as *gomma* (bleeding) and *cagna* (foot-rot).

The citron was the first of the citrus family introduced into Europe. In its bearing and general appearance it is the most strongly characterized of the genus. The tree is low, with a full head; it is strong shooting; its shoots are tender and straggling; its leaf is large, thick, oblong, wingless, and toothed. Changes occur at short intervals in the vitality of the tree. It frequently happens that healthy shoots live but one or two years; hence, the necessity of cutting off the vertical shoots to prevent sudden disturbances in the head of the tree that would exhaust its strength. The diseases of the citron are constitutional, and prematurely destroy its life. The most promising subjects suddenly cease growing, and become chlorotic; the branches gradually turn yellow, and are often covered with scabs, from which exudes coagulated sap resembling gum; the sores assume a cankerous appearance, and the tree dies. The citron's dying out to such a great extent in this province was due principally to its propagation by cuttings. It has been found that where the citron was budded on an orange seedling, and more especially on a sour orange, it acquired a stronger constitution, and did not grow in such a straggling manner. The citron blooms at all seasons of the year. The flowers are white inside and purplish outside. Black ants destroy many of the blossoms. Once set the fruit grows rapidly. Citrons often weigh from six to eight pounds. The fruit presents a bumpy appear-

ance; its base is full and flat; its perfume is delicious. It is necessary to prop up the branches of vigorous trees, as unassisted they could not support their heavy fruit. Good culture doubtless would improve the nature of the citron and perfect its development, but it cannot prolong its life, which is very short compared with that of the citrus family generally.*

Citron trees receive the same attention as the orange and lemon trees among which they grow. From March to October these trees are worked five times. Irrigation is found indispensable. During the summer—the dry season—the trees are watered twice a week. The average cost of cultivating an acre in orange or lemon trees is $50 a year. The distance between these trees is from fourteen to twenty feet, according to the soil and the location.

Shipment of Citrons.

The citrons now exported from Messina are brought from Reggio, in Calabria. They are shipped in brine, and are prepared as follows: The citrons are cut in halves, thrown into casks, and salted—one hundred pounds of salt to the cask. The casks are then filled up with sea water, and turned on their side. The citrons are left to soak from fifteen to twenty days. The casks are then opened and the citrons weighed; seven hundred and seventy pounds of citron are allowed to the cask; sea water and a little salt are added, and the cask is ready for exportation. A small auger-hole in the bung permits the gas produced by fermentation to escape. The casks are of chestnut. They cost $3 apiece, and contain one hundred and five gallons. It costs $1 a cask to cut and salt the citrons, and $1 a cask to pack them, cooperage included.

Prices and Exports.

A citron tree bears from thirty-five to fifty citrons, which are worth to the grower from 5 to 10 cents apiece. First quality citrons weigh one pound and upwards. Last year citrons on the tree sold for $20 the two hundred and twenty pounds. November 1, 1885, they brought $17 the two hundred and twenty pounds; December 1, 1885, they fell to $12 50. Salted citrons, November 1, 1885, were quoted at $64 the cask; December 1, 1885, at $59. November and December are the great shipping months; the fruit is then half grown and half ripe.

The Custom House statistics show, for the year ending December 31, 1884, that four hundred and fifty-five thousand four hundred pounds of citron in brine, valued at $16,560, were exported from Messina. No preserved fruit is shipped from this port. England, France, Genoa, and Leghorn are the principal markets for the "citron of commerce."

WALLACE S. JONES,
Consul, Messina.

* For the above details I am indebted to the comprehensive work of Prof. F. Alfonso, "Coltura degli Agrumi."

NAPLES.

REPORT BY CONSUL CAMPHAUSEN.

Cultivation.

The cultivation of the citron begins with the sowing of the seed of the bitter orange, being the same seed from the fruit of which marmalade is made.

After four or five years, when the seed has produced plants or small trees, they are transplanted, at the time of blossoming, in regular rows, at a distance of twenty-five centimeters.

When they have a diameter of eight centimeters they are grafted with small citron branches. The grafting is indispensable to give long life to the trees and hasten the production of the fruit.

Three years after the grafting the tree is transplanted into a ditch one and one quarter meters wide and one and one half meters deep, at a distance of four meters from one another. In planting the trees in the ditch particular care should be taken not to injure any part of the roots.

The leaves are taken from the trees and the branches cut back to the length of twenty centimeters. The ditch is filled with earth to a depth not exceeding twenty-five centimeters, left sufficiently loose to allow the roots to spread with ease, and prevent smothering the plants. If the plants do not sprout at once the earth on the roots is loosened and moistened.

For fertilizing, old horse manure, or other old manure, is to be applied. No fresh manure ought to be used, because it would be injurious and have a tendency to kill the plants. Manure should be used only in the winter, between October and March, and be placed at a distance of ten or fifteen centimeters from the roots. Around the tree a deepening, in the shape of a basin, should be formed, and, unless the ground be moist or damp, the plants require frequent applications of water during the summer.

In Sorrento the planting is done from March to June, according to the state of the temperature; grafting during the same months. The rest of the cultivation is the same as for the orange and lemon. Hoeing, and pruning of useless limbs, are done in May. The tree requires great protection against severe cold or very warm winds, as well as against hailstorms. In order to give it as much protection as possible, hedges are planted and coverings of straw matting, or something similar, provided, having regard to the situation of the tree and the means within reach of the cultivators. The plant is much more tender and delicate than the lemon.

The tree blossoms between March and May, and up to the months of September and October, at which time the fruit is ripe. In about two years' time the grafts will begin to bear fruit, and after six years, if the ground and climate suit, the tree will bear from forty to fifty kilograms of fruit a year, and when in full age up to two quintals, and perhaps more.

The greatest part of the expense in the cultivation is caused by covering the tree to protect it against the winds. In milder climates this expense is not incurred, and the only outlay is for manuring and hoeing. These expenses vary according to the price of labor in the different

localities. When the ground is of the right kind—that is, loose and moist—the climate mild, there is a great profit made in the culture of the citron.

The exact amount of the profit cannot be given, as it varies according to the price obtained for the fruit, which is subject to great fluctuations, ranging from 15 to 100 lire per quintal on the ground. This year, for instance, garden citrons have sold at from 30 to 70 francs or lire a quintal on the ground. Some years when Corsica, where the citron is cultivated to a very large extent, gave large crops, the fruit sold for 15 lire a quintal, while at other times, when the crop was small, 100 lire a quintal was paid.

Packing and Preserving.

This fruit is packed the same as lemons, wrapped in paper and boxed or barreled.

The fruit is not candied for exportation in this neighborhood, but sent to Leghorn or Genoa, to large factories for this industry.

The information received on the subject of preserving the fruit is as follows:

The citron is cut in two or four pieces; it is then placed on the fire and boiled until the inside can be easily taken out with a spoon, then soaked in cold water for four or five days, and the water changed twice a day until the citron has lost its bitter taste. To every kilogram of fruit one kilogram of sugar and one liter of water is added, and placed over a slow fire and left standing for two days.

Then one hundred grams of sugar to every kilogram of fruit is added, and the boiling process repeated, left again for two days, and then again repeated at intervals until the syrup is thick. The fruit is then dried in an oven or before the fire, and can be exported in wooden boxes.

According to another authority, the fresh citron is divided, the pulp taken out, and the rinds are then steeped in brine for several weeks. They are then boiled in syrup until the rinds are quite cooked; they are next dried and boxed, as above described.

Others, again, after taking the rind out of the brine, boil it in water for two days, changing the water two or three times per day and beginning each time with cold water; then one kilogram of sugar to one half kilogram of water is taken; put into the quantity of syrup thus made one kilogram of the rind, as above prepared. Each day, for six or seven days, bring the fruit now in the syrup to a heat in which you can just bear your hand, adding fifty grams of sugar each time. Let the fruit in this syrup become cold, and, as above, add fifty grams. Make another syrup of one kilogram of sugar to one half kilogram of water; boil for one half hour; then take the fruit out of the first syrup and put in the last prepared, which should be exceedingly hot, and boil the fruit ten minutes, stirring it at the same time. Thus the last syrup is absorbed by the fruit, and it becomes dry.

The citrons, both fresh and in brine, are exported in immense quantities from Messina, Palermo, and other places, to foreign countries, but chiefly to the English markets.

EDWARD CAMPHAUSEN,
Consul, Naples.

CUBA.

REPORT BY CONSUL PIERCE.

In the District of Matanzas the citron, though not indigenous to Cuba, is to some extent cultivated here, but not as an article of commerce. Scarcely any attention is paid to its cultivation, and, like a great many other useful products, it is almost entirely neglected, owing to the prior preference for the staple product, which up to this day is the sugar cane.

It may be surprising that an article so universally growing in the island should not appear as an article of export, but to one well and thoroughly informed as to the tendency of the agricultural class here, it is not surprising. Nearly every farm house, garden, or plantation has a few citron trees growing. The soil is eminently adapted to its cultivation, and, in the production of it it is flourishing and florescent; but as small cultivations have been entirely abandoned in preference to the sugar cane, there has been neither foreign exportation nor an interior commerce in the article—at least, in this district.

The citron is used to a limited extent here as a tonic and for preserves. In its use as a tonic or medicinal article, only the outside bark or peel is used. The interior is used as a refreshment and for preserves.

The citron is grown on a bush about nine feet high. From the time of planting, in about two years, fruit may be expected.

It will grow in any ground, but rich earth is naturally preferable. As the fruit has never been attentively cultivated here, it is almost impossible to digest the many opinions given by the isolated cultivators who have given it any attention; but I have given what I deem a fair synopsis of the various data obtained, and will add that it is deemed and classified as hardy as the orange.

Propagation may be done by planting the seeds (but production is later in this way) or by cuttings; or, as in the case of the banyan tree, by intertwining branches, which readily take root.

FRANK H. PIERCE,
Consul, Matanzas.

MADEIRA.

Acting Consul J. Hutchinson writes from Funchal, under date of December 3, 1883:

"The cultivation of the fruit on the island is on so small a scale that it is impossible to obtain any definite information. There are a few trees in two or three districts, on the lands of small holders, who never think of making any calculation as to the cost of culture, yield, or profits.

"The fruit is sent into town in small parcels for sale to the shippers. The present prices range from $1 to $2 per hundred, according to size. The buyer places the fruit in a cask with sea water for shipment. It all goes to London, the average annual shipment being about fifty casks of one thousand citrons each."

MEXICO.

Consul James Viosca, of La Paz, Mexico, reports, under date of November 24, 1885, that while the citron has never attained a commercial importance in Lower California, the tree thrives luxuriantly, bearing

yearly an abundant crop of very deliciously flavored fruit, weighing from one to five pounds each, thus proving the fitness of the soil did a market exist for the produce. A small quantity of the green or seasoned fruit is yearly exported to the ports of Mazatlan and San Blas, for domestic uses in making sweet preserves, or what is known as *fruta enbuelta en azucar* (fruit covered with sugar). Otherwise it has no commercial importance.

THE ORANGE AND THE LEMON.

CONTINENT OF EUROPE.

FRANCE.

REPORT BY CONSUL BRADLEY, OF NICE.

Oranges and Lemons on the Riviera.

Varieties.—Among the hundred and over varieties of citrus fruits grown on the Riviera, it is impossible to specify any one or two as most profitable. The oranges are not only exported as fruit, but orange-flower water is distilled from large quantities of their flowers (one firm alone using seven hundred thousand pounds of flowers). Tons are candied green. Neroli, so much used by the perfumer, is extracted from other varieties, and from the dried peel curaçoa is manufactured.

From recommendations given I have selected eight varieties of oranges as among the most useful.

Oranges.

Orange franc (*Citrus aurantium vulgare*).—Stem straight and vigorous, bark gray, head hemispheric, whose branches, numerous and confused, are covered with thorns. The young sprouts are angulous, and of tender green color. The lower leaves thick, oval, lightly notched, light green; upper leaves oblong, darker green, glossy, entire, on a long stem, less winged than the under leaves. Flowers axillary and terminal, white petals, ovary often striated at the base. Fruits average size, rounded, globulous, sometimes slightly concave at top, where the place that the style occupied is always apparent. The stem end frequently shows the striæ noticed in the ovary. Skin golden yellow, slightly rough, and covered with vesicles. The pulp is divided into eight or ten compartments, full of large vesicles nearly as yellow as the skin, which hold a juice abundant, palatable, and sweet. Seeds large, oblong, unequal, each inclosing three or four perfect germs. The tree grows here to be twenty-four feet high, its head, say, twenty-seven feet in circumference; in warmer climates a little larger. It commences bearing at eighteen or twenty years of age. The fruit grows sweeter as the tree grows older. It ripens early, and resists cold better than any other variety; not much cultivated on account of slow growth, and because the fruit is much of it spoiled for transportation by the thorns, but the stocks are much used for grafts of other varieties.

Orange de Nice (*Citrus aurantium nicense*).—Differs but slightly from the above; it is a favorite because of the keeping qualities of the fruit, and the readiness with which a graft from it starts.

Orange de Malte (*Citrus aurantium melitense*).—Skin dark yellow, shading into red; the pulp may be red in part or wholly. It is considered to be a hybrid between the Franc and some East Indian species.

Orange à Pulp Rouge (*Citrus aurantium hierochunticum*).—The skin of this orange is always yellow, never red, but the pulp is dark red. This variety differs little from the preceding in appearance and form.

Mandarin(*Citrus madurensis, or Citrus deliciosa*).—Already well known in California. Here it is one of the hardiest varieties.

Orange bigaradier Franc (*Citrus bigaradia*).—Root long, branchy, bearded, light colored outside, yellowish within. Trunk straight, grayish, branches bushy, covered with long greenish thorns. Young sprouts are pale green, angulous, like most of the genus; leaves elliptic or oblong, narrow, acuminate, lightly notched in the upper part, wavy, a fine green, and carried on stems more or less winged. Flowers in clusters, have calix angulous, five petals, taste slightly bitter, from thirty to thirty-five stamens partly adherent at the base. Ovary round or striated, surmounted by a style, terminated by a tuberculous stigma. The fruit is of average size, round or slightly elongated, smooth or sometimes rough, flattened at the end, yellow to reddish orange color. The peel is bitter, very fragrant, clinging to the pulp, which is yellow, and divided into twelve or fourteen parts; its juice is not very palatable, bitter, acid taste. The seeds are oblong, sharp, and yellow. The tree grows here to the height of about twenty-seven feet; flowers in May and sometimes in autumn; fruit ripens slowly. Neroli is distilled from its flowers, and from its dried peel the liquor curaçoa is made.

Orange de Chine, bigaradier, or Chinois (*Citrus bigaradia sinensis*).—A valuable dwarf variety, about twelve feet high; resists the cold well. The orange is used for preserves or candied fruit, and a water is distilled from its flowers.

Bergamotier ordinaire (*Citrus bergamia vulgaris*).—The Bergamotier is naturally lofty, plenty of branches, but the branches are so brittle that the head of the tree is rarely well filled out or regular. Its leaves are oval, oblong, some pointed, others obtuse, average size, green, the lower surface whiter than any other orange leaf, leaf stems long and winged. Flower white, small, fragrant, scattered or united in clusters, borne on very short stems. Fruit good sized, usually pyramidal, rarely round, yellow, smooth, glossy. It has an agreeable fragrance peculiar to itself, peel thin, pulp yellowish green. This variety is chiefly valuable for the essential oil obtained from its flowers and peel.

Lemons.

Lemons being generally seedlings, a very large number of varieties are produced, which even proprietors of orchards do not try to distinguish. Twenty or thirty varieties have been classified.

The following are said to be among the most valuable: Lemonier ordinaire (*Citrus limonum*), vulgare; Lemonier imperiale (*Citrus limonum*), imperial; Lemonier bignette (*Citrus limonum*), bignetta; Lemonier perette spatafore (*Citrus limonum*), peretta spatafora. This last is excellent in damp situations.

The lemons thrive only in the sheltered nooks within a mile or two of the sea, where every deep warm valley has its small orchard ripening, not only from the direct rays of the sun, but from the warmth thrown back by the cliffs around them. The more hardy oranges can be found ten miles from the coast among the mountains, as high as nine hundred to one thousand two hundred feet above the sea. Our only level land is in small valleys among the Alpes Maritimes, which cover all this district. It is generally noted that this fruit ripens earlier on hillsides where water can be brought to it.

The soil best adapted to them here is a silico-argillaceous or argillo-calcareous soil, the latter, when not too damp; but any good mixed soil seems to answer, as they are not difficult.

In regard to temperature, M. J. Tesseàre gives observations taken by him covering twenty years. The minimum during that time being 26 degrees; maximum, 92.5 degrees; average, 60 degrees Fahrenheit in the shade. These observations were taken three times daily: sunrise, 2 P. M., and at sunset. In the sun at 2 P. M., the thermometer marked minimum 99 degrees, maximum 135.5 degrees, averaging 112.1 degrees. Lowest night temperature, 26 degrees; highest, 79 degrees. There are but few sultry days. During the twenty years there were 4,385 days almost or entirely cloudless, 1,547 cloudy days, 1,348 days more or less rainy, 28 days without observation. This would give in one year 219 sunny days, 77 cloudy, 67 rainy. The hygrometer of Saussure gives minimum of 23, maximum 77, average 61.4.

For the five years, 1870–74, the minimum rainfall was in 1874, 24.3 inches; the average for the five years was 35.1 inches. The peculiarity of the rainfall is the tropical intensity of each shower and its short duration; so that while we have actually more rain than London, England, we have very much fewer rainy or cloudy days. During the long summer, from June to September, the trees are irrigated with water brought in canals from mountain streams, which is generally tempered by storing in large private tanks for some time before being applied, which is at intervals of one or two weeks. This is done in summer, between sunset and sunrise; if necessary in autumn, it is done in the morning. Gardeners watch the leaves of the tree for indications of need of water. The orange needs less water than the lemon.

The earth is worked over twice a year; in the spring, after pruning, at least a foot deep; again in the autumn not quite so deep. The tool used for this work is always tined, as a blade might injure the smaller deep roots. It is considered desirable to cut away the roots which lie near the surface, as they are injured by becoming too dry, and the tree suffers. The deeper growing roots are better for the tree to draw sustenance from, as they keep moist longer.

Fertilizers are used for two definite purposes, and at two different epochs: First, to press the growth of the young tree with manure, speedily decomposed, which will furnish strong nutriment at once to the roots, such as oil-meal cakes, guano, dried blood, stable manures; second, for the support of the mature tree with manures of slower decomposition, such as horn shavings, bones, woolen rags, hair, hide, and even leather. These are placed around the tree as far from the trunk as the roots extend during the autumn, and covered with earth to the depth of a foot.

The object aimed at in pruning is to bring the greatest possible surface

of the tree to the direct action of air and light. The spherical form is considered best. To keep this form, shoots are pinched off in June each year. In the early spring, weak and dead wood, forgotten useless shoots, are cut out to let light and air in among the branches; a sharp knife must be used.

Oranges are picked first when just beginning to turn yellow, in October, for distant shipment; next in December for a nearer shipment, when half yellow; finally in the spring, when fully ripe, for home market. They are sold by the thousand, the Caisse, or Patronne. The best are wrapped in gray paper and packed three hundred and sixty in a box, and called Caisses Flandrines. The second quality are packed in the same way, five hundred to the box, and called simply Caisse. The third quality, packed the same way, is called Caisse de Menton. The fourth quality are called Patronnes de Magasin, and the fifth Patronnes de Barque. These latter are shipped by boat in bulk. Those poorer than the above five qualities have no commercial value, excepting for the peel, which is taken off and dried. Oranges as a rule grow sweeter with the age of the tree.

Lemon trees blossom from the earliest spring to late fall, and even during the winter. From the few fertile flowers of late winter comes a large thick-skinned fruit with but little juice, called Testassa. The early spring flowers, from which good fruit ripens in about six months, or in October and November, are the ones most depended on for a crop. These lemons are called here "Primo Fiore," or "Maraviglia." The next flowers of May and June only ripen their fruit after ten months, which are called "Secundo Fiore," or "Granetta." These are generally inferior to the "Primo," but if for any reason those fail, Nature tries to make up for it by putting all the good qualities lost with "Primo" into the "Secundo." The flowers of July and August mature the following April and produce the "Verdame," which is said to keep well for shipment. After the rain of September and October, a few flowers are fertile and give a coarse fruit called "Septembrine."

The fruit, carefully picked, is spread on straw, where the different commercial qualities are selected. They are wrapped in absorbent paper, and packed according to size, and given the following commercial names: Caisse Flandrine, four hundred of the best size in a box; Caisse Lyonnaise, five hundred in a box, and Petites Caisses, where three boxes hold one thousand of the smaller ones. The lemons of the first class in size must be at least fifty-five millimeters in diameter.

The plants are propagated by seed, grafting, cuttings, and layering, principally by the first two methods. When planted in the orchard the distance apart is modified, first, by the kind of culture, whether in large orchards, when other plants are to be cultivated between the rows, and Nature allowed to take its course, or in small gardens, where a system of forcing is used; second, the quality of the soil, and, finally, the form in which they are to be set out, whether in one row, in squares, etc. In a general way, from fifteen to twenty-four feet is near enough for trees of standard size.

The trees begin to bear flowers and fruit at five years, give a reasonable crop at fifteen, but increase in productiveness up to forty years.

Insect Pests.

The following insects are hurtful to both orange and lemon trees, but as the lemon tree is always in flower and is more frequently watered, the *Lepidoptera* in the larva state is more injurious to it than to the orange:

Coccides.—Dactylopius citri (*Bois Duval*).—This insect with soft tegument is very common on both orange and lemon trees of the Riviera. Its body is a red brown; about it are numerous cottony appendices, seventeen on each side; at the end of the abdomen are two much longer than the others. The insect is entirely covered with white dust. Its length is $0.^{m}003$ to $0.^{m}004$, breadth $0.^{m}002$. The antennæ of the female are eight-jointed. The tarsis is half the length of the tibia; the thread-like feet are very long. Web pores are plenty; the genito-anal ring large, with six bristles; the larva has antennæ six-jointed; the abdominal web pores are less numerous than in the perfect insect. The male is long, brown on head and thorax, abdomen yellowish; the feet and antennæ darker in color; these latter have ten articulations. Thorax narrow; elytron very long, grayish white; abdomen very long, with web pores on the edges; sexual organs tuberculous in form, quite large, terminated in a rounded point; feet long; tarsis longer than the thighs.

This insect, a veritable scourge, forms upon the young fruit and leaves cottony and sticky heaps, contrasting strongly by its whiteness with the color of the fruit and the black layer of the "Morphée," which always surrounds them. Breaking off these living heaps, some of the insects will be crushed, yielding a reddish liquid; in them will be found insects in different stages of development, and besides this the larvæ of the Coccinella and the caterpillar of a little *Lepidoptera*, the *Ephestia guidiella*.

The *Dactylopius citri* seeks sheltered spots where the trees, too closely planted, lack air and light. It hurts the growth of the trees by stopping the leaf pores. It unites with the *Lecanides* and the *Aphides* to propagate "Miellat" and "Morphée."

Aspidiotus limonii (*Signoret*).—This Coccus with hard tegument, which is found particularly upon the young branches, has, according to M. Signoret, the lobes at the abdominal extremity detached and apparent, and the fimbriate scales long; the last abdominal segment is elongated. The shell of the adult female is spherical, yellowish white in color, with internal organs yellow, and a large quantity of eggs. The shell of the male is more elongated. Raising the shell of the mother when the little ones are being hatched, numerous small white larvæ running quite fast among the eggs, yet unopened, can be seen. These resemble the Phylloxera, excepting in color. The male is quite common; his head is notched in front, the antennæ are long, thorax rounded and broad.

Lecanium hesperidum (*Auctorum*).—This insect is clothed with a solid cuirasse. It is elongated in form; its color a yellow brown. It adheres firmly to the leaves, and is difficult to distinguish from them. Its antennæ have six articulations, legs slender, claws very long, genito-anal ring surrounded by six bristles. Larvæ long, with six articulations in each antennæ. The male has not been described. Examinations of the female show embryo, but no eggs, which gives rise to suggestion that she may be vivaparous.

Lecanium oleæ (*Bernard*).—Brown, with deep body and two raised transverse lines on the back, almost heart-shaped; the antennæ have

eight articulations; yellow at first, they become black. The female lays her eggs and shelters them under herself in great quantities.

The methods in use by the best gardeners for the destruction of this form of pest is to powder the tree with a mixture of sulphur and plaster from April, and to brush trunks, branches, and fruit during the winter. Washing with waters, saline, alkaline, or acid, which might harm the plant, are given up; syringing with medicinal liquids is also discouraged. Carbolic acid, turpentine, or petroleum dilutions are preferred for brushing on, the latter as the cheapest, with water in proportions of one to thirty. These should be applied at night in spring. It is also recommended to wash the trunk with lime water, and to cut off and burn on the spot at night the small branches too much attacked to be cured. Another author advises the use of nitro-benzine, but the essential things seem to be plenty of light and air through and among the trees, and, above all, protection of wild birds.

Lepidoptera.—Acrolepea citri (*Milliere*).—Tincidæ described by Milliere and Rangouet. The female probably lays her eggs, which are round and of a bright yellow color, near the bud. The young larva soon hatches; it is at first, to the naked eye, a yellowish white, and retains this color some time. At the moment of its final transformation, when it is largest, its body is yellowish green in color, which is particularly noticeable in the hollow of each ring and on the under parts. The head, dark brown, has antennæ, or horns. The eyes are very apparent. A marked distinction between this insect and the *Prays-olellus* is that the latter has, upon the first thoracic ring, two bright, black spots, which are wanting in the *Acrolepea citri*, whose first ring is simply a darker shade. The body of the larva is a yellowish green color, and has six brown feet, armed with little claws, darker brown. The false feet, to the number of eight, are placed under the sixth, seventh, eighth, and ninth rings. They are provided with an apparatus with short filaments, which allows them to adhere or cling strongly to any object. The last abdominal segment is conical, and notched at the anal extremity. It is provided with the same apparatus as the false feet, commencing with the first thoracic ring; the covering is delicately marbled with a reddish color. Preserved in alcohol, the larva, which has lost its greenish tints, becomes yellow, the back a darker shade, the eyes and mandibles very black. Very lively, it burrows in the bud whose covering it has pierced, and leaves a round hole very apparent. Once settled in the bud, it commences by devouring the base of the stamens; then it attacks the embryo of the fruit. It is found, sometimes, at the bottom of the calyx enveloping the base of the fruit, still very small, with its rings, trying to get into it; moving from place to place, it emits thread, which binds the stamens together and incloses its excrements. When the flower attacked opens, the stamens are seen to be upset, and the young fruit, pierced at several points, soon blackens and dries up, even before it is as large as a grain of wheat. If the larva is disturbed, it quickly leaves the inside of the flower and crawls about the outside of it; then, if there seems to be danger, it tries to reach another branch or the ground, dropping down by the thread spun from itself, by which it climbs up again when the danger seems past, absorbing the thread into itself as it goes up. The larva being fully developed, it prepares to spin its cocoon in the calyx of the flower.

The cocoon is a gray-brown, meshes so loose that the phases of trans-

formation can be easily followed; once really shut in, the caterpillar shrinks rapidly. Larvæ commencing their cocoons the twentieth and twenty-first of September, yielded a butterfly the twenty-sixth or twenty-seventh following. Its sleep then lasts but six or seven days. At first the little chrysalis, in its cocoon, is a greenish color on its under parts, the upper parts, and a line upon its front, red. After this the green and red fade and it becomes a light brown, verging toward green, which darkens more and more. At its birth the butterfly is almost black; it is only later that it pales and the varied designs appear upon its dress. It is motionless, antennæ stuck to its body, legs drawn up under it, looking like a small black spindle; when well dried it straightens its antennæ, which it carries pointing forward, and always in motion. It raises its head, stretches out its legs, and makes its toilet; at the slightest alarm it changes its place with a jerky little flight. The designs on the wings of these butterflies vary much, and sometimes disappear completely, to give place to a general mouse-gray color, more or less silvery.

A general description of a good specimen of this insect would be as follows:

The body mouse-gray, under part silvery; head the same color, eyes are large, the dark antennæ half the length of the body.

Examining with care, a black line forming a half crescent is apparent at the commencement of the prothorax; near the center of the folded wings, or in the front third, a second black spot appears resembling the letter A, with top flattened and lacking the transverse bar. The top points toward the head of the insect; the sides are on the two wings. Further back is a third black spot similar to the second, but very much fainter, and the final point of the wings, a darker gray than the rest, make a last noticeable spot. The specks on the wings are too small to be called spots. The three pairs of legs are of different lengths; the second pair has one spur, the third has two. In color they are gray, with black wings.

I have only studied these insects during the blossoming season of August. Professor Penzig, who has made longer studies of them, says that there are three generations in each year; the first in April and May, the second in August, and the third in October and November; according to him the winter is passed as an egg from this last generation. The first generation in the spring from these eggs is not strong or prolific, and not so harmful. The August generation is the most mischievous. They were first noted as hurtful in Corsica, later in Sicily, by M. Panizzi. The methods of destruction used against this insect and the next two are to pick up and burn the flowers attacked, and to gather all grass and weeds growing near the trees, dry them, and burn them in heaps under the trees at nightfall. A great many butterflies attracted by the light are destroyed, besides other forms of insect life, under the burning heaps.

Ephestia guidiella (*Milliere*).—A Phycide described by M. Milliere, of Cannes, who gave it this name because he first found it upon *Daphne gnedium*, a shrub quite common on the hills. It seems to be polyphagous, however, as it is found on many plants; besides this they are found under the whitish, sticky, cottony heaps deposited on fruit and leaves by the *Dactylopius citri*.

It has the form, but is a little larger than the *Acrolepia*. It differs

from the latter in color, being blackish, with a band of darker shade on each side, dotted or marbled. The larva is hairy; there are hairs even around its eyes. Its head and first thoracic ring are a brighter color. Placed in alcohol it is a lighter shade, becoming a chestnut, the band on the sides very marked. It is very lively, seems to flee the light, and is longer in preparing for its transformation than the *Acrolepia*. It first makes a loose shelter, in which it spins a cocoon, impenetrable and whiter than that of the other, and while longer in preparing the cocoon, it is at the same time longer in changing from chrysalis to butterfly, nine days instead of six. The butterfly is larger and a dark gray. Its wings, instead of being folded in a spindle shape, are folded more in the shape of an acute angled triangle. The body is mouse-gray beneath, a little darker above. The abdomen is well furnished with hairs. The under part of the wings is a brilliant ash-gray. The upper wings are fringed only at their extremity and on the inner side. Their general shade is lees of wine, with metallic luster; two light designs cross them. When its wings are spread this color is brighter, but the design fades and nearly disappears if the insect is long on the wing. The under wings have a darker shade above than below; their fringe is long, especially the outer edge; a dark line separates the fringe from the rest of the wing. The legs are an even gray, something the shade of the under part of body and wings. With wings spread the *Ephestia guidiella* measures about $0^{m}.015$, while the *Acrolepia citri* measures but $0^{m}.010$ or $0^{m}.012$. Professor Penzig thinks it has but two generations. The discovery of the larvæ of these insects in the heaps made by the Cocci, raises the question, yet unsettled, whether they feed upon the latter, and so are not wholly harmful.

Eupithecia pumilata (*H. G.*).—A beometride larger than the *Ephestia*. As the butterfly varies in its markings, so the larvæ of this insect vary so much as to make detailed description difficult. Its body is cylindrical; six true legs appear, but those on the tenth ring and on the twelfth and last are false. The body is yellow-green, with black lines on the sides. In the middle of the back a longitudinal line, from which, on each ring, a line runs at right angles down the sides; the body is covered with thinly scattered hairs. The chrysalis, yellow-brown, is quite slender.

The specimens of the butterfly that I have raised are a gray-yellow color, brighter beneath than above. The eyes are large and greenish. The under wings are marbled, with little irregular blackish spots. They are notched in the back part and have a darker line serving as base to the fringe. The upper wings, larger and darker, have the same dark line. On the field there are, besides the spots which the under wing bears, designs lighter and darker.

The Diptera are represented by one small fly, in color blue, striped with yellow, which lives in its larva state in the pulps of the oranges. It is the *Cerutitis hispanica* (B.). M. Peragallo could find nothing more detailed than this fact noted by Colonel Goureau.

Of Coleoptera, the *Curculio-otior-hynchus meridionalis*, which attacks the young shoots of the olive, is equally fond of the orange tree, and all lemons which fall on the ground in damp places are pretty sure to contain more or less of the dark yellow *Carpophilus mutilatus*, and to show the small, round hole in its skin by which entrance was effected. To

obtain a specimen, it is only necessary to squeeze the lemon, and the *Carpophilus* comes out with the juice, but not wet by it.

The Morphèe, or Fumagine.—After years of study and discussion of this disease, which gives the leaves of a grove the appearance of being coated with soot, scientists have united in the belief, well founded, that it is due to the liquid excrement of one of the Cocci in which germs of mushrooms find congenial soil for growth, and do grow very rapidly. To prove the power of this insect to eject to some distance its excrement, M. Peragallo confined in a glass insect case several live specimens of the Coccus on orange tree leaves already affected with fumagine. Within twenty-four hours the glass was sprinkled with tiny drops of a viscous liquid, white and transparent, which had evidently been produced by the insects, and which were soon covered with fumagine from germs in the air. For its cure, the Abbé Loquez says:

> Have no excess of humidity, plant further apart, give the trees air, let them grow tall, be moderate with irrigation—water gives fruit but is liable to injure the tree—finally, burn the infected branches.

M. Riviere suggests lime water washes, fumigating with tobacco, washing and brushing the leaves, branches, and fruit. Dr. Signoret adds hanging wisps of straw soaked in coal tar under the trees. At Menton, petroleum and vinegar water are both used as washes.

Two methods are given in the record of the Entomological Society of France for 1883; the first from Greece, the second from Sicily:

1. Prune well, and syringe the trees with the following mixture: Eight parts water, with one each of petroleum and quicklime, finely powdered.

2. Powder the trees while damp with dew with fresh or unleached wood ashes.

To sum up, keep the trees healthy, do not plant in low places or where there is much fog, cut off sickly branches, and destroy by hand as many insects as possible.

"Gum" shows great weakness, and probable death of the branch on which it appears; it is considered to be a cryptogamic disease. M. Peragallo gives the following insects which seem to be friends of the orange and lemon trees:

Syrphus hyalinatus (*de Fallen*).—From larvæ found at Menton and Roqueburne, in whose neighborhood were quantities of the larvæ of *Acrolepia citri*, black and dried, were developed in his breeding cases a Diptera already known as destructive to the Coccide, identified as the syrphus fly *Alinatus* (de Fallen). This insect is considered by M. Peragallo as one of the most useful parasites of the lemon trees, living as it does on different kinds of insects hurtful to the tree, and being quite common in some sections. He has found also in the chrysalides of Microlepidoptera, larvæ which gave birth to tiny Hymenoptera as yet unnamed, and in one case records the birth of a *Hemerobius chrysops* from the chrysalis of a *Eupithecia pumilata*; these latter cases being more truly in the nature of parasites than the *Syrphus hyalinatus*.

List of Oranges and Lemons grown on the Riviera.

Citrus Aurantium.

Vulgare.	Melitanse.	Nobile.
Sinense.	Hierochunticum.	Longifolium.
Depressum.	Balearicum.	Multiflorum.

Pyramidale.	Sigillatum.	Augustifolium.
Ilicifolium.	Mammiferum.	Tardum.
Crispum.	Limetiforme.	Aspermum.
Piriforme.	Oblongum.	Grassense.
Latifolium.	Ellipticum.	Coniferum.
Genuense.	Olivæforme.	Imbigum.
Duplex.	Torulosum.	Lusitanicum.
Nicense.	Carnosum.	Otaitense.
Microcarpum.	Rugosum.	Mutabile.
Minutissimum.	Ruginosum.	Lunatum.
Gibbosum.	Pomum Adami Parisiorum.	Loursiro.
Corniculatum.		

Citrus Bigaradia.

Corniculata.	Spatafora.	Hispanica.
Sulcata.	Mamillata.	Florentina.
Fetifera.	Longifolia.	Coronata.
Canaliculata.	Volcameriana.	Glaberrima.
Cyathifera.	Racemosa.	Dulcis.
Caliculata.	Neapolitana.	Salicifolia.
Crispifolia.	Asperma.	Sinensis.
Multiflora.	Itan.	Myrtifolia.
Violacea.	Sallesiana.	Fasciata.
Duplex.	Macrocarpa.	Bizarria.

Citrus Bergamia.

Vulgaris.	Parva.	Mellarosa Plena.
Torulosa.	Mellarosa.	

Citrus Limetta.

Vulgaris.	Hispanica.	Aurania.
Parva.	Romana.	Pomum Adami.
Acris.	Tuberculosa.	

Citrus Pompelmos.

Decumanus.	Crispatus.	Ragemosus.
Vulgaris.	Shaddock.	

Citrus Lumia.

Dominica.	Valentina.	Aurantiaca.
Rhegina.	Gallitia.	Rubescens.
Conica.	Dulcis.	Limeta.
Ollulæ formis.	Saccharina.	

Citrus Limonum.

Sylvaticum.	Barbadorus.	Oblongum.
Incomparabile.	Neapolitanum.	Canaliculatum.
Tenno.	Globosum.	Imperiale.
Striatum.	Parvum.	Lauræ.
Pussillum.	Hispanicum.	Racemosum.
Calabricum.	Balotinum.	Rheginum.
Caly.	Mellarosa.	Sancti Remi.
Bignetta.	Peretta.	Nicense.
Bignetta magna.	Peretta Spatafora.	Paradisi.
Hardonium.	Peretta Striata.	Ferrari.
Rosolinum.	Peretta Florentina.	Amalphitanum.
Aspernum.	Peretta Longa.	Chalcedonicum.
Ponzinum.	Vulgaris.	Bimamillatum.
Duplex.	Ceriescum.	Digitatum.
Ligusticum.	Cajetanum.	
Roseum.	Fusiforme.	

Citrus Medica.

Vulgaris.	Plena.	Sulcata.
Cucurbitina.	Dulcis.	Costata.
Tuberosa.	Florentina.	Glabra.
Maxima.	Elongata.	Simoniformis.
Cornuta.	Rugosa.	Parvra.
Salodiana.	Romana.	

WILLIAM HARRISON BRADLEY,
Consul, Nice.

GENOA.

REPORT BY CONSUL FLETCHER.

Oranges and Lemons.

The genus *Citrus*, for economical cultivation, is divided into three classes—the orange, citron, and lemon.

Varieties.—The varieties of oranges generally cultivated in this province are:

(1) *Citrus Bigaradia dulcis*, or sweet orange.

(2) The Melangola of China, or *Citrus Bigaradia sinensis*.

(3) *Citrus deliciosa*, or Mandarin orange, aromatic and saccharine.

Two kinds of citron are cultivated:

A. *Citrus medica rugosa*, wrinkled fruit, very good candied or otherwise preserved.

B. *Citrus medica cedrato*, a very precious and aromatic fruit, the shell of which is also candied.

The following are the varieties of lemon raised here:

A. *Citrus limonum*, a lemon very good for its acid and medicinal virtues.

B. *Citrus limonum tenno*, a lemon of gentle rind, fruit rich in acid, but too tender to stand transportation.

C. *Citrus limonum oblongum*, an oblong lemon, considered very valuable on account of the quantity of acid it contains.

These three varieties are ranked as the best, and therefore are cultivated the most in this vicinity.

Productive Age.—Citrus fruit trees give full crops when about, say, from sixteen to twenty years old, and they keep yielding excellent crops for many years afterwards. It is not often that these varieties become very old, say, not over one hundred years. The foliage expands to a remarkable degree, and an average plant will usually produce five thousand fruit per annum; especially can this be said of the lemon tree.

Planting.—Before the malady *gomma* (gum) manifested itself it was preferred to multiply the trees by burying the ends of shoots in the ground at the proper distance; these shoots soon took root, but now the seed of Melangola is planted, into which, when grown to a certain size, the qualities desired are grafted. The Melangola tree up to the present time is in a very healthy state, and forms a good trunk on which to graft all varieties required. Citrus fruit trees are planted at a distance of about seventeen feet apart on flat land, and from thirteen to fourteen feet apart on hillsides. The shade of one tree on another is injurious to the blossoming of the latter; therefore, care should be taken that fair space be given all the plants in order to have Nature do its best for man. The average number of trees in a hectare of land (or 2.471 acres) is four hundred and ninety, and with this number as a basis from which to calculate, it gives a space of about twenty square meters for each tree.

Situation of Orchards.—Orange and lemon orchards in Liguria are all on the seacoast. Flat and hilly lands in orchard are alike protected by lofty mountains from northern winds. This state of affairs appears necessary; the temperature must be constant, for even the slightest frost damages the lymph of the plant and juice of the fruit. Orange and lemon groves can be, and are, cultivated inland, but the temperature in

such places must not reach higher than 40 degrees Centigrade, and not lower than 2 degrees; or by Fahrenheit scale, 104 degrees and 32 degrees. Inland orchards usually do well around lakes on account of the constant climate. Groves are also to be seen on tablelands, but always on the south side of mountains; in such localities the temperature is as given above. Citrus fruit trees need a damp soil, and if the land does not contain sufficient moisture, it is impossible to obtain a good crop. On naturally dry soil, therefore, water near by is of great value.

Orchards in this province and in all Liguria are near the sea and protected from the cold northern winds by mountains. Many small groves can be seen beside stone walls, to which the branches cling, particularly the lemon. The land throughout this province being so mountainous, it must be taken for granted that but few orchards can be seen on so called flat lands.

Cultivation.—Orange and lemon groves, on account of the irregular formation of the surrounding country, are necessarily small, and they are owned by about as many people. On account of this natural abruptness and irregularity, added to the fact that the orchards are not large, it is the opinion of the owners that irrigation is too expensive. Further, the soil on which groves are planted is what the Italians term strong, and it is claimed for it that it retains moisture for a long time. Again, an idea prevails among the people that springs are of no great depth here, and consequently the water therefrom courses through the earth, and at no great distance from the surface, and that such an existence waters the roots without the aid of man. A happy belief. Certain it is, however, that at Nervi, a few miles along the coast from Genoa, orchards thrive with but little irrigation, and this state of affairs is noticed even in the driest seasons. Unless groves have strong soil, as above mentioned, and are moistened by an unseen watercourse, they will prove unprofitable if the owners do not nourish the dry roots as often as, say, once in eight days. In the first four or five years cultivation between the plants is possible, but when the tops of trees reach a certain expansion cultivation would seem impossible, or, at least, improbable.

Produce and Expense.—When the tree reaches between the ages of fifteen and twenty years, each one is expected to yield abundant fruit, the orange from four hundred to six hundred, and the lemon from six hundred to one thousand. On strong soil and with proper care as the orchards advance in years, it is said that a lemon tree will yield from three thousand to five thousand fruit per year. The ground is manured like in the olive groves, with some kind of compost, etc.

Summary.

Oranges and lemons are not raised in such quantities in this consular district as to admit of large exportation, but the trade in olive oil is a big item.

The following table is copied from advanced sheets of what is designed as an accurate report of the importation and exportation of olive oil, oranges, and lemons, for the year 1883, to be soon issued by the Chamber of Commerce of this city.

Exports of Lemons and Oranges.

La Plata States	30,102
France	32,532
England	8,750
Egypt	4,577
Total	84,961

Imports of Lemons and Oranges.

France	6,878	
Tripoli and other African ports	66,155	
Egypt	1,830	
Total		74,863
Total exports over imports		10,098

JAMES FLETCHER,
Consul, Genoa.

MESSINA.

REPORT BY CONSUL JONES, OF MESSINA.

Oranges and Lemons.

Varieties.—Best variety for profit, the *Citrus lusitanicum* (orange); *Citrus lusionium* and *Citrus fusiforme* (lemon). Other choice varieties worthy of culture and for profit are the *Citrus bergamia* (bergamot); *Citrus deliciosa* (mandarin); *Citrus luiretta.* There are some thirty other varieties of less note.

Location.—The finest lemon groves are in the neighborhood of Briga, Pezzuolo, Giampilieri, Santo Stefano, Saponara, and Rometta. The finest orange groves are at Francavilla and Rouella, in the valley of the Alcantara.

Distance from Sea.—Lemon trees do better nearer the sea than orange trees; they thrive at from one quarter to two miles from the shore; orange trees from two to six miles.

Elevation.—The greatest elevation at which lemon trees do well is fifteen hundred feet. Orange trees do well at twenty-seven hundred feet above sea level.

A southern exposure is best, but it requires the most water. A northern exposure is generally too cold. An eastern exposure exposes the trees to April frosts. A western exposure is always damp.

The lemon, like the vine, delights in hillsides, facing south. Plains, as well as hillsides, are well suited to the orange.

Soil, etc.—In this district the finest lemon groves are on argillo-calcareous soil of the Tertiary period, and on calcareo-argillaceous soil of the Quaternary period. These two soils are the best for both oranges and lemons. Sandy soil is not well adapted to orange and lemon culture, as it is too thirsty. When grown on sandy soil these trees are small, and their late fruit (fruit from the last June blossoms, which at latest must be gathered in February and March) is spongy and unfit for transportation. Oranges do better than lemons on sandy soil.

Climatic Influences.—The climatic influences in this district are seldom injurious to orange and lemon trees. The lemon requires an equable climate to produce perfect fruit. The orange and mandarin are hardier and suffer less from sudden changes of temperature; they do well at a higher elevation than the lemon, and at a greater distance from the sea.

Temperature.—The temperature in this orange and lemon district ranges from 34 degrees to 100 degrees Fahrenheit; should it, however, exceed those limits for a few hours only the trees soon rally. During the winter of 1887 the mercury fell to 22 degrees, and the tender twigs were frozen; these being at once cut away, the trees were none the worse for the cold. During the summers of 1888 and 1890, the mercury rose to 103 degrees; an extra supply of water soon made the trees look as green as ever.

The average temperature is 96 degrees in summer and 42 degrees in winter; mean annual temperature, 70 degrees. Nights cold or warm; sultry, moist, ordinary atmosphere.

Spring and autumn the nights are frequently cold, and still always above freezing point, however, and do no damage.

Warm nights increase the evaporation but do not injure the trees. In March and April the cold at early dawn sometimes blights the blooms, which would otherwise produce the "bastard," or late fruit.

During the summer the atmosphere is seldom if ever dry. In winter the air is dry when the wind is north, which rarely happens. West and northwest winds are damp. The prevailing wind is the sirocco (southeast); it is generally warm and moist.

The average moisture of the atmosphere is 0.025 millimeters; quite inadequate to the successful culture of the orange and lemon. Only groves of the stiffest clay or calcareous soil with a wet subsoil can dispense with irrigation. Oranges stand drought better than lemons.

There are but few sultry days except in the early spring, when the atmosphere is saturated with moisture; at this period rain is not wanted, and often proves destructive to the crops.

The average annual rainfall is twenty-two inches. From April to September it seldom rains, but pours in torrents in September and October, causing great damage. The heavy rain during the night of October 1, 1889, destroyed a number of groves. Light, steady, and constant rains occur in March and April.

Rain in May and June damages the blooms. Rain in September helps to develop the bastard fruit. Too much rain causes the trees to become chlorotic, and predisposes them to the "gum;" it also makes the fruit watery and destroys its keeping qualities.

Irrigation.—Generally speaking, throughout Sicily orange and lemon culture is impracticable without irrigation. There are a few exceptions to this rule, however, in certain favored localities.

The trees are watered for the first time in June, when the fruit from the early blooms is the size of a pea, and the trees are still in bloom.

The amount of water required to the acre depends upon the age of the trees, the nature of the soil, altitude, exposure, etc. On an average, each lemon tree, on moderately moist soil, requires two hundred liters of water at each watering; two thousand liters of water a year.

Cultivation.—Vegetables are planted between the rows until the trees are large enough to shade the ground. Young trees are, in consequence, worked six times a year. When the trees have attained their full growth they are worked but seldom.

The first working of a full grown grove takes place in October or November, after the autumnal rains have made irrigation unnecessary. A grubbing hoe is used to stir the soil, cover the weeds, and draw away the earth from the foot of trees. The second working is in March, when

the earth is thrown back to the foot of the trees. The third working is in April, after which the land is trenched, and a basin is made around each tree.

Fertilizers.—These groves are badly fertilized, as there are no good fertilizers here. Stable manure is so mismanaged that it furnishes but little plant food.

Fifty-five pounds of stable manure are applied annually to each young lemon tree. These gardeners are now finding out that this amount is too great, although the manure is of an inferior quality.

Lemon groves in bearing are manured every three or four years; fifty-five pounds of cow or stable manure to the tree.

Some gardeners put the manure in the irrigation trench, and let the water spread it around the trees; others scatter the manure around the trees, turn it under, and then irrigate. Experiments are being made with sulphate of ammonia.

The best time to fertilize orange and lemon trees is from April to May. To obtain "bastard" fruit the trees are fertilized in October.

Pruning.—A tree is never pruned until it is four years old, its suckers and badly placed branches only having been cut away up to that time. Trees are generally pruned in March, after the crop has been gathered, but no precise date can be given. These trees are always pruned high from the ground; their lowest branches are at least seven feet above the soil, except when they are directly exposed to winds from the sea, in which case they are kept low, that they may escape, as much as possible, from the salt spray. Pruning should not be practiced in summer, as, at that season, the wounds are hard to heal and are apt to predispose the trees to gangrene and other diseases.

Picking.—Lemons are gathered from October to August; oranges, from November to April. Lemons are picked whilst immature, for foreign markets, and should not weigh less than eighty grams each. Lemon juice and essence are extracted from inferior lemons. The greatest care is necessary in gathering the fruit not to bruise it. After the stems have been cut close the fruit is wrapped in tissue paper and carefully packed in boxes containing from three hundred to three hundred and sixty lemons, and from one hundred and sixty to two hundred, two hundred and forty, three hundred, and three hundred and sixty oranges.

Tree Planting.—One hundred and sixty-two trees are planted to the acre.

Propagating.—The lemon is now budded on the bitter orange stock (*Citrus bigaradia*). Prior to 1870 the seedling only was budded, but this tree having been destroyed by the gum, the hardy bitter orange stock has taken its place. The several varieties of oranges grown are also budded on the bitter orange stock.

Varieties.—The best varieties are budded; seedlings never reproduce their own variety.

Orchards.—The orchards are generally small, averaging from five to seven acres. The high prices that ruled a few years ago induced small land owners to plant out orchards, but prices having fallen, and diseases having made their appearance, many of these orchards have been abandoned.

Maturity.—Trees begin to bear at six years of age, and are most prolific at twenty. The greatest age of the average tree is fifty years. Orange trees sometimes last eighty years.

Insect Pests.—A number of insects attack orange and lemon trees: The *Aspidiotus aurantii*, ants, *Mytilaspis fulva*, *Lecanium hesperidum*.

The most troublesome of the parasites is the Coccus, which belongs to the order of the *Hemiptera*, and to the sub-order of the *Homoptera*, and is vulgarly called the scab. In the spring it propagates rapidly in damp, warm weather. It prefers the lemon to the orange. This is very detrimental to trees that are overshadowed by taller trees, or that have not had their heads opened out to let in light and air. Remedy: A solution of lime.

The *Kermes aurantii* is partial to the orange, and punctures its leaves. Remedies: Solution of lime, solution of sulphate of copper, kerosene, infusion of tobacco.

The best way to get rid of ants is to destroy their hills in February with kerosene; fumigations of sulphur are also resorted to.

The *Mytilaspis fulva;* remedy: solution of phenic acid. The *Lecanium hesperidum;* remedy: sulphur fumes.

Beneficial Insects.—The *Coleoptera* (of the cochineal family) and the *Hemiptera*, above mentioned, feed on the Aphides.

Parasites.—There are no known parasites of the injurious insects. Small birds, if preserved from ruthless sportsmen, would prey upon these destructive insects.

Picking and Curing.—The fruit is gathered in baskets lined with cloth, and piled at the foot of a tree, where expert workmen trim the peduncles close to the fruit, and examine each orange and lemon, selecting the choice ones for exportation. This fruit is then carried in large baskets to the warehouse, where, after a second careful inspection, women wrap it in tissue paper. The fruit contained in each box must be of the same size. These packers are most expert in classifying the fruit. Sight and touch are the only sizers used. If the boxes are kept for any length of time in warehouses, they are opened once every three weeks that their contents may be carefully reëxamined, and the damaged fruit removed. Time is the only curing process for both oranges and lemons.

Keeping Quality of Sicily Lemons.

Properly speaking, no process for curing lemons is employed by the fruit growers of Messina. That lemons grown in the Messina District keep perfectly for months before being put on the market, is due to the great care in gathering, handling, and packing the fruit, to their keeping qualities derived from the nature of soil on which they are grown, climate, and variety cultivated.

First—The lemons are gathered with great care, the peduncle being cut (not broken) off smoothly near to the lemon. The fruit is carried to the warehouse in baskets lined with cloth, where it is spread out on the floor (if of wood) or on large mats (if the floor be of stone), and allowed to dry from twenty-four to forty-eight hours—even longer if there is sufficient room in warehouse, but never more than six days. If lemons piled, say, four feet deep are left for any length of time, the first layers become greatly heated, and soon spoil. The fruit, having been carefully selected, is next wrapped in tissue paper and packed in boxes. Upon reaching the city warehouses, the exporters, before shipping, have the boxes reinspected; the least defect in the fruit causes its rejection. When packed for the last time prior to shipping, care is taken to pack

each lemon with its point down. If the boxes are kept any length of time in warehouses, they are opened every three weeks and each lemon carefully examined. A lemon with a blemish, so slight as to be noticeable but to an expert, is thrown out as unfit for exportation. Lemon juice and essence are extracted from these rejected lemons. The fruit contained in each box must be of the same size—an easy matter, owing to the monthly harvestings. Sizers are unknown here.

Lemons are gathered from October to August; they should not weigh less than eighty grams each, or average more than from two and one half to three inches in diameter when gathered.

There are three harvests of the true lemon—the November cut, the December-January cut, the April-May cut. The true lemon is produced from the April-May bloom; the bastard lemon, from the irregular bloom of February, March, June, and July. The true lemon requires nine months to attain maturity. The true lemon keeps much better than the bastard. Lemons gathered in November are of a deep green color; after remaining in boxes from six weeks to two months they turn light yellow. Lemons cut and packed in November show three hundred to the box; the same lemons (having shrunk), when repacked in January, show three hundred and sixty to the box; later shrinkage is scarcely noticeable. The November-cut lemon keeps better than that of any other cut; shipments of this lemon are frequently made as late as May to New York. Lemons gathered in January are of a bright yellow color, and are not kept more than a month in the warehouses here before shipment.

Second—The soils best adapted to the lemon are the argillo-calcareous and the calcareo-argillaceous. Sandy soil is not well adapted to lemon culture, as it is too thirsty, etc. The lemon requires an equable climate to produce perfect fruit; in this district, climatic influences are seldom injurious to the fruit. The lemon does best on hillsides, facing south. It thrives at from one fourth to two miles from the seashore, and at an elevation of one thousand five hundred feet.

Little or no chemical fertilizers are used in these groves, and stable manure but sparingly. Water is the great fertilizer on this island.

May not our fresh soils and chemical fertilizers affect the keeping qualities of California and Florida fruit?

WALLACE S. JONES,
Consul, Messina.

PALERMO.

REPORT BY CONSUL CARROLL.

Oranges and Lemons.

The following are the best varieties cultivated in Sicily, viz.: *Citrus bigaradia macrocarpa*, Riss; *Citrus bigaradia coronata*, Riss; *Citrus bigaradia glaberrima*, Riss; *Citrus medica glabra*, Riss; *Citrus medica florentina*, Riss; *Citrus bergamia* (variety *Vulgaris*), Riss; *Citrus bergamia* (variety *Mellarosa*), Riss; *Citrus aurantium piriforme*, Riss; *Citrus aurantium precox*, Riss; *Citrus deliciosa*, Ten.; *Citrus limonum fusiforme*, Riss; *Citrus limonum oblongum*, Riss; *Citrus limonum calabricum*, Riss.

The following varieties are also cultivated, each having its special merits, viz.:

	Varieties.
Citrus bigaradia	21
Citrus limetta	7
Citrus lumia	1
Citrus medica	8
Citrus bergamia	2
Citrus aurantium	22
Citrus deliciosa	1
Citrus limonum	19

Planting and Propagating Lemon and Orange Trees.

Orange trees are planted five meters apart, and lemon trees from five to six apart, depending on circumstances.

The old lemon and orange gardens in this vicinage are generally either the result of certain succulent slips, which were cut from the trees and buried, or planted, two thirds of their length in moist, friable ground, or, of in curving or bending a live branch, without detaching it from the tree, and inserting it to a depth of about thirty centimeters in rich, soft, friable soil. At the end of about two years, or when sufficient roots have sprouted from the branch thus bended, in order to enable it to live without the mother tree, the branch in question is detached therefrom and allowed to proceed, in growth, on its own account.

This method of propagation has become almost extinct. There are certain cases, however, in which it is still resorted to, because of the rapidity with which the trees develop, and which make it preferable to any other, as well as on account of the abundance of the yield of trees thus propagated. But the fact that such trees are susceptible of attack by *mal de gomma*, and readily destroyed thereby in a few years, has convinced even the most steadfast adherent of the method that it should be abandoned and a resort had to propagation through the several varieties of the melangoli seed, called here Aranci amari (*Citrus bigaradia*), and the trees thus derived grafted with the various varieties, as they resist the malady in question with much more vigor. In fact, the orange and lemon trees of Palermo, which are generally obtained by the seed of the melangoli, have resisted the *mal de gomma* much better than those of Messina, which were formed from plants derived from lemon branches. The best varieties are budded.

The orchards in Sicily are very large, and are, in view of the great profit ensuing therefrom increasing rapidly.

Fructification.—They fructify at the age of three years, the yield being largest thereafter, from year to year, up to the twentieth, when they are becoming old and subject to all diseases. At this period they are denuded of their branches and a new graft resorted to.

Insect Pests.—The most troublesome insect, and that which injures the orange and lemon trees most, is called *Coccus hesperidum*, Linn., or *Coccus citri*.

The facility with which this insect propagates itself, and the rapid increase consequent thereon, result, in a comparatively short time, in the death or serious injury to the trees. The mode of attack of this insect is by eating a hole in the tree, from which soon exudes a profuse flow of juice, resulting in death or serious injury thereof, as stated.

The *Coccus citri* lodges in trees having thick leaves, and especially in those shaded by larger trees or plants. In this contingency pruning

is resorted to, with a view of letting in light, and thus causes the insect to seek another refuge or die. No specific is known to combat this insect, but the usual mode of relief therefrom is by washing the trees with lime water.

Other very injurious insects abound, such as the *Kermes coccinus*, *Kermes hesperidum*, *Kermes aurantii*, *Lecanium hesperidum*, and *Pidocchio*, which prefer the orange to the lemon trees. These, too, are destroyed by lime water, solutions of copper, sulphate thereof, etc., petroleum, snuff, etc.

Beneficial Insects.—Terrestrial formicas, or ants, destroy other destructive insects and their eggs, but in their absence they gnaw the tender branches and leaves, thus causing them to atrophy. Therefore all efforts are made to destroy the ants as in the case of other insects, hoeing the ground in winter being resorted to as a means to that end, thus exposing them to inclement and cold weather, death generally ensuing as a consequence.

Parasites.—The lichens, which attach themselves to old trees, those attacked by *mal de gomma*. Shady and moist places favor the development of lichens. Sea water is used as a wash to get rid of this parasite.

The fumagine evoluting from the agglomeration of microscopic plants, is technically called capnodium, or *Fumago citri*. The fumagine attacks all varieties of oranges and lemons and causes grave damage. The trees attacked suffer greatly, the yield thereof being very small. The fumagine attacks the trunks, branches, leaves, and fruit. Only the epidermis or outside of the fruit is attacked. This parasite is destroyed by means of pruning and manuring in January.

Lemon and Orange Groves.

The trees that produce the varieties named at the beginning of this report are grown in Sicily.

Distance from Sea.—There is no fixed distance from sea for planting orange and lemon trees. There are many orange and lemon gardens in the vicinity of Palermo, bordering on the sea, some of which prosper better than those situated more inland. This, however, obtains only when the gardeners are skilled men, and give particular attention to the ground, and adopt proper means with a view of protecting the trees from strong sea winds.

Elevation above Sea Level.—It is impracticable to determine with accuracy the elevation at which orange and lemon trees can be cultivated, the latitude and certain special conditions influencing this. In Sicily, for instance, oranges and lemons are profitably cultivated along the seacoasts at an altitude of from one hundred to five hundred meters above sea level, and often much better crops are obtained where the elevation is from five hundred to one thousand meters.

Exposure to Sun.—It is of great advantage when the gardens have a southern exposure, or when the sun beams down upon them from sunrise to sunset. This exposure is recommended by gardeners here.

Position of Orchards.—Orange and lemon trees are indifferently planted in the vicinity of Palermo in hilly, rolling, or level land. The nature of the soil, climate, exposure to sun, attention to the soil, trees, etc., seem to be the principal requisites; elevation, all other things

favorable, having little or no influence, save as to quality. Fruits produced on hilly land are more appreciated, and generally command higher prices than those produced on rolling or level land. There are exceptions to this, however. In Palermo, for instance, fruits produced on certain level lands command as high prices as those produced on hilly land; with this exception, however, the land best adapted to the cultivation of oranges and lemons is generally hilly. In fact, the fruit dealers mark their fruits with an "M," which signifies "Montagna," or "Mountain," which enhances their price, as seen from the following comparison, viz.:

Fruits produced on hilly land, 25 to 50 lire per thousand; on rolling land, 21 to 27 lire per thousand; on level land, 17 lire per thousand.

Soil.—Considerable attention has been given of late years to the character of the soil, subsoil, etc., best adapted to the cultivation of the fruits in question, as well as to the chemical composition of oranges and lemons, which has resulted in the belief that calcareous land, containing certain other material necessary to the life of all vegetation, is the best, in order that they may contain the requisite amount of lime, potassa, soda, etc. The soil best adapted to the cultivation of oranges and lemons is at least one meter in depth, and devoid of rocks, and accessible to water for irrigation, else the trees die.

Deep, clay land, open and exposed to the rays of the sun, accessible to water, abounding with alkaline salts, minus rocks or stones, little or no grass, not exposed to strong winds, rains, or frosts, etc., is deemed to present the best advantages in all respects.

Climatic Influences.

Temperature.—The temperature in the adjacent territory of Palermo, in summer, does not ordinarily exceed 35 degrees Centigrade, and rarely falls lower than 20 degrees, and in winter the maximum is 23 degrees, and the minimum 10 degrees. Consequently, the average summer temperature is 27½ degrees, and that of winter 16½ degrees, the average annual temperature being 22 degrees.

Neither cold nor warm nights, in the territory conterminous to Palermo, seem to wield an influence upon the result of the cultivation of oranges and lemons therein. Sultry days, although frequent in summer, and occasional warm or cold spells, appear to exert no detrimental influence upon either lemons or oranges. For instance, the fruits in question flourish quite well where the thermometer does not fall below +3 degrees Centigrade in winter, nor rises above 34 degrees in summer. It has been observed in Palermo on various occasions that the orange and lemon trees resist a summer sultry temperature of 40 degrees Centigrade, and that of —2 degrees in winter, without any apparent detriment, while many other plants or trees were destroyed or damaged.

The atmosphere in and conterminous to Palermo in winter is almost invariably humid or moist, while the climate is mild. In summer the atmosphere is very warm with little moisture, save immediately on the seacoast, the sirocco which often obtains making life of all kinds perilous. During this period irrigation is lavishly resorted to in order to keep the trees alive and preserve the fruit.

Rainfall.—The conditions of temperature and climate in Sicily are exceptional, compared with other parts of southern Italy. The strong,

constant winds which prevail in winter condense and accumulate the vapors, over which they traverse, into a small compass, and as a result the rainfall is often so copious as to inundate entire localities. Rain commences about the latter part of September, and ends in April, twenty-two inches falling within the interim named.

When rain falls in large quantities the trees are damaged; but in small quantities it is advantageous to them.

Irrigation.—The cultivation of oranges and lemons, in Sicily, generally cannot be undertaken, unless the trees are irrigated from spring to autumn, or when the land is not adjacent to springs, the drippings from which serve therefor, or when springs do not exist in the subsoil, the filtration of which sufficing to maintain the ground in a moist state during summer. The custom of opening canals parallel to the rows of orange and lemon trees into which water, accumulated in an elevated reservoir, is allowed to flow, thence into and between the openings or small depressions between the rows of trees, until the ground is thoroughly saturated, the more remote points from the source of the water being irrigated first, until finally the irrigation water and it source coalesce or meet, obtains here.

In the best conducted orange and lemon gardens in the vicinity of Palermo, irrigation is resorted to every eight days during the first year of the growth of the trees; every twelve days during the second and third years; every fifteen days during the years from the fourth to the eighth, inclusive, and from the eighth year forward invariably every twenty-two days.

Orange and lemon gardens require, on an average, three hundred and fifty cubic meters of water for each irrigation to the space of one hectare of land in good condition.

Great attention is necessary as to the amount of water required. If too much is used the trees are subject to a disease called "*mal de gomma*," literally translated, "illness of the gum," or "gum disease." If too little, development is delayed, and even their death may ensue.

Cultivation.—April and May are the best months in which to cultivate orange and lemon trees, the inclement weather having terminated, thus insuring the safety of the buds.

Oranges and lemons are cultivated from the dry seed, which costs 1.80 lire per kilogram, or from the fresh plants containing the seed, the latter requiring more attention than the former.

Planting or sowing, as the case may be, commences in April, as stated, or later, in order to avoid the white frosts, the ground being previously prepared.

Trees resulting from dry seed are generally good and strong, and attain a height of at least one meter, before being grafted with a view of propagating the various varieties desired.

The gardeners of the Province of Palermo recommend that a distance of about five meters should intervene between each orange tree when the ground is level, and about four meters in undulating, rolling, or declivitous land. Lemon trees are recommended to be from five to six meters apart, when large trees are expected or desired, as is the case with all trees derived from "Cedrangoli amari" (*Citrus bigaradia*, Riss).

The best means of planting trees is by placing them in parallel lines from north to south, in order that they may be equally exposed to the sun's rays throughout the entire day, and so placed as to form a series

of equilateral triangles, with a tree on each angle. To this method of planting the name Losanga has been given.

It is customary during the early stages of the growth of lemon and orange trees to alternate them with other plants, such as vines, cotton, etc., in order to give them strength and nutrition, as well as to utilize the necessarily large vacant spaces of ground.

At the expiration of ten years, however, or when the orange and lemon trees have become so large and tall as to obscure the plants in question with their branches, etc., they are taken up and utilized in a new field.

Fertilizers.—Alkaline substances are better adapted than any other materials for fertilizing. Gardeners in the vicinity of Palermo formerly used seaweed, mixed with the excrements of horses and cows or stable accumulations.

Fragments of dressed leather, woolen rags, scrapings from horns, and certain other remains of old or cast-off manufactures, as well as decayed fruits, are regarded as the best admixtures of fertilizers for oranges and lemons. The materials or substances in question are stratified in proper places with a view to their fermentation before being used.

When trees are planted they are abundantly manured, and after one year the ground around them is cleared away to a depth of forty centimeters, forming a circular ditch, with a diameter of two meters, into which two baskets of manure, or about twenty kilograms, are deposited, whereupon the ditch is covered with the earth previously removed, placing it so as to form a shallow ditch around the tree. This operation is resorted to in January and February. Small trees are manured twice a year, for the first five years, viz.: in March and August.

Ordinarily, however, when trees prosper, manuring is resorted to only every three years, the quantity used being about forty kilograms to each tree.

Pruning.—The first pruning is made after the expiration of the third year. The height from the ground depends on the quality of the land in which the trees are planted, as well as the desire for either high or low trees. When the land is exposed to northern and southern winds, it is better that the trees should be low; but inversely, should this exposure not obtain.

In Palermo, as in all Sicily, the orange and lemon gardens are pruned from December to June, while the trees are devoid of fruit, the process being governed by the gardener's interests and experience rather than by any theoretical suggestions.

Gardeners take care to clip or clean the trees yearly, cutting off all old and useless branches. Pruning is resorted to every three years.

*Picking and Curing.**

Oranges are picked from November to March, and lemons, from November to August. The first picking is generally made in Novem-

* In a subsequent dispatch, Consul Carroll says that, "in connection with preserving oranges and lemons after being taken from the trees, it may be proper to say that this consulate is often applied to for information as to the supposed or alleged means resorted to here for that purpose by California and Florida fruit growers, and to repeat, for the information of fruit growers in the United States, that there is no process resorted to nor known here to preserve the fruits in question other than folding them in fine tissue paper, which is changed from time to time, and the fruit examined and all contaminated oranges and lemons eliminated from the baskets or boxes in which, for the time being, the fruit may be placed. Precaution is also taken to place or keep the fruit in question in a dry, equable temperature.

"Oranges and lemons are generally picked before maturity."

ber; the second, in December or January; and the third, in March or April. During the summer months, however, such as are verging on maturity are picked from time to time.

Oranges and lemons for export are picked prior to maturity, and thus shipped to ripen on the voyage.

Oranges and lemons for export are not cured, but simply selected with a view to bearing the long voyage. Those not shipped, and for which a sale is not readily found in the markets of Palermo, are preserved, from March to August, in well ventilated caves or grottoes, to be sold to ice cream dealers for the purpose of making ice cream, jellies, lemonade, etc.

Packing and Shipping.

When oranges and lemons are picked they are carefully selected and wrapped in tissue paper, packed in open boxes, and placed in the warehouse. Again, before shipping, they are carefully selected, newly wrapped, and packed.

Generally speaking, lemons can be divided into two categories, viz.: normal lemons and abnormal or anomalous lemons. The normal are those that bloom in the months of April and May, and the abnormal or anomalous those derived from the blossoms of February, March, June, July, and other successive months, and which depend on waterfalls, to a more or less degree, during warm weather, for irrigation.

The normal lemons arrive at maturity in about nine months—that is, from May to January, inclusive—the picking thereof being commonly made in three successive periods, viz.: from November onward. The lemons picked in the first period are green, and those picked in the third period more mature. They are picked according to the requirements of the purchasers. The first and third pickings are more valuable than those of the second, consequent upon fruits being more abundant during the latter period.

The fruit under consideration is believed to be the best, and by gardeners is classified as first class fruit and sold at very high prices.

The fruit picked at other times is called anomalous.

Lemons are picked by men who, if the trees are too high to permit their doing so from the ground, climb up and detach them, taking care to leave a piece of stem, placing them in baskets lined with linen, on the handle of which is a wooden hook tied in order that the baskets may be hung on the branches. So soon as a basket is full it is lowered from the tree by means of a rope, provided with a knot, and exchanged for an empty one by a boy known as "panieraio," or, literally, "basket maker," whose duty it is also to empty the baskets in the place designated by the "taglia piedi" (peduncle cutter). This is an expert workman in his line, who performs two offices at the same time, viz.: cuts the peduncle of the lemons close to the crown, and afterwards separates the good from the bad lemons, depositing them in two separate heaps. Small lemons, although they may seem to be good, if of less weight than eighty grammes, are, as a rule, not exported.

It is estimated that out of the total lemon crop about two thirds are considered fit for export, the remaining third being utilized in the manufacture of acid, essences, etc.

The "taglia piedi" (peduncle cutter) places the lemons on a straw bed, in order to protect them during the voyage from damage.

When lemons are classified, girls place them in baskets lined with linen. Each girl places in her basket two hundred and eight lemons, four lemons at a time, thus making fifty-two operations or movements, and, when completed, places the basket on her head and conveys it to the warehouse.

In the warehouse good lemons are placed in flat lots one and three tenths meters high, where they are allowed to remain from five to eight days, in order to determine their strength, at the end of which any decayed or damaged lemons which may be found are picked out. This is not, however, general, especially when the producer of the fruit is not the shipper, and has no interest in the shipment thereof. It is only done in cases where the shipper has purchased the fruit, or the producer ships it on his own account.

In the warehouse, near the gardens, the lemons are wrapped with tissue paper, placed in boxes, the interior of which is lined with paper of the same kind. The boxes, so prepared, are carried into the city warehouse, where the lemons are taken out of the boxes and a new assortment made, and, in order to ship them, the above operation is repeated.

Should the boxes not be promptly shipped for any cause, and remain in the warehouse some time, then it is in the interest of the person on whose account the fruit is to be shipped to assort them, in order to ascertain if there are any damaged fruits among them.

The fruit is shipped in boxes of the following dimensions, viz.: breadth, 29 centimeters; height, 42 centimeters; length, 81 centimeters.

The number of lemons which each box contains depends on their size, and in order to be exact the fruit is divided into four categories, as follows, viz.: two hundred if of the first category, two hundred and forty if of the second category, three hundred and sixty if of the third category, four hundred and twenty if of the fourth category.

Boxes are divided into two compartments, each containing half the number stated above, placed as follows, viz.:

First category, in four strata, twenty-five per stratum; second category, in four strata, thirty per stratum; third category, in five strata, thirty-six per stratum; fourth category, in five strata, forty-two per stratum.

PHILIP CARROLL,
Consul, Palermo.

SICILY.

REPORT BY CONSUL LAMANTIA, OF CATANIA.

Oranges and Lemons.

Varieties.—The names of the best varieties of oranges for profit are: The common orange (a round fruit); the calabrese (a long keeping fruit); the sanguigno (a blood-red orange); the oval (a late, sweet, and good keeping); the mandarino (mandarin, the largest one).

The names of the best varieties of lemons for profit are: *Il limone comune* (common lemon for trade); *Il bergamotto* (for making essences); *Il cedro vero* (citrus medica, for preserving).

Situation.—The same are located in low and high land, as well as all around Mount Etna, at a distance from three hundred to six hundred meters from sea, at an elevation from five hundred to six hundred meters

above sea level, exposed to sun, on level lands, because it is better, and in rich, calcareous soil.

Climatic Influence.—The minimum temperature in January is 0.5 degrees Centigrade; the maximum is 35 degrees Centigrade, in August, and the average, 17 degrees, in May.

Nights in summer are rather fresh, and cool in winter. Days generally clear, seldom moist, and good atmosphere.

Rainfall from twenty-five to thirty inches for year, and rain in proper season helps the growth and the fruits greatly.

Irrigation.—Irrigation is done by spring and stream water, and by well water elevated by steam or horse power.

The groves, with said water, are generally irrigated at option, and whenever needed, as lemon trees bear all the year.

Cultivation.—The following information I have been able to gather by personal visits to the owners of the beautiful large groves of orange and lemon trees, the production of which forms one of the principal resources of the country, viz.: When it is wished to plant a new lemon grove, the gardener from November to April prepares in the best spot of his garden a well manured seed plot of two square meters, whereon he sows a quarter of a gallon of bitter orange seed, and covers the same with about two inches of fine earth. Two months later you see the young plants out of the ground, and during the coming summer the seed plot is to be watered at least every four days. After one year the young plants are at a height of eighteen inches, and then the gardener prepares a large seed plot to plant the same, at a distance of eighteen inches apart, where they are left till another year. The new ground is hoed about two and a half feet deep, and divided in square compartments of one and a half feet each side, in the corners of which are located the largest seedlings taken out from the seedling bed, leaving there the smallest ones, to be replanted later on.

This method of planting is called by these gardeners *mettere a casella* (planting in cell). There they are kept for the second year, with good care, the stems being fastened to sticks driven in the ground alongside, in order to grow straight and to protect them from the wind.

On the third year the seedlings are already grown sufficiently to be replanted in another larger place, in order to give them more room. Consequently half the largest ones are again dug up and planted in another prepared bed.

This second method is called planting in *piantonaio*. Here the plants are left until the fourth year. In January or February of the fifth year the grower divides all his ground, already prepared during the previous fall, in square compartments of fourteen feet long each side, and in the corners of each one he digs out round ditches, with some well manured animal compost mixed with the earth. It is proper, however, to note that the young trees are always to be kept free from sprouts, and watered and manured diligently. This operation is done as follows:

Every fifteen days the ground is removed from the bottom, and the grower around the tree forms two circles, one of a foot and the other of two feet in diameter. Then he removes the ground from the base of the tree about five inches deep, and fills it with manure, covered with the same ground. This operation is also recommended for large old trees.

In the fifth year the said trees of bitter orange seedlings are grafted into lemons, or oranges if desired.

Fertilizing.—A lemon grove must be dug at least three times a year: that is, on the first of January, pretty deeply, and the ground manured. if possible, in all its extension; (2) In the month of April, for forming the *conche* (compartments) and gutters for watering in the hot summer: (3) In the middle of June, for weeding. In the fifth year the young bitter orange trees will be grafted.

Grafting.—Although no inquiry is made about grafting, yet I may give some details of the methods used in Sicily. Grafting is done in *becco di flauto* (beak of flute), by *spacco* (splits), or by *scudo* (shield). This last one is generally practiced in this island, and the proper season is in the month of October or May. The first method is called "*ad occhio dormente*" (sleeping eye), because it is necessary to await the coming spring season to see whether the grafting has turned out well. The second is practiced by smarter agriculturists, and is called "*occhio vivente*" (living eye), for the reason that should it fail, in the coming fall it is operated again. The shoots are to be chosen from the best and most vigorous adult trees, and so at the end of the seventh year you will have a good producing young lemon grove, fruiting all the year around.

A fifteen-year old tree generally produces five hundred lemons, while at twenty it yields over one thousand. Professor Cassella states that he has seen several very large old trees producing as many as ten thousand fruits per year.

Pruning.—Pruning is done according to the growth of the tree. The method used in Sicily is *a tronco rovesciato* (capsized cone). This form is practiced from the time the tree is young, by cutting the main trunk and letting the lateral branches grow, in order to have free ventilation and free sunlight, and to effect the fruits to maturity.

The height of the trees varies according to locality and usage of the country. In Messina, for instance, they are left pretty high, while in this province they are kept low, on account of strong winds, which sometimes prevail around Mount Etna.

Picking.—The regular season for picking lemons in this district commences from October, in low lands, and in November, on high lands, up to the end of January. That is called *il primo taglio* (first cut), and the fruits are considered the best for quality and long keeping. The second cut, larger than the first one, begins in March and lasts until the end of April, and the last one, or third cut, known as *verdelli*, from May to the end of September. Finally, lemons bear all the year around.

Orange picking commences in low land in November, and on the *montagna* (mountain) from January to April. These are the best fruits, and durable, fit for packing and shipment. The same are always picked a little greenish, and not in full maturity; but they acquire their natural bright color after they are wrapped in tissue paper and boxed for shipping.

Before shipment, however, they are chosen into four different sorts; that is, first and second choice fruits are thoroughly examined, to be entirely free from thorn touch or any disease, and they are shipped for farthest markets. The third choice are sent to near markets, and with the fourth one is made essence and *agro cotto*.

The fruit is gathered with care, the stem is cut with a very sharp round-bladed knife, and left to the eye to prevent decay.

Planting and Propagating.—The distance planted apart must not be

more than sixteen feet, for the reason that if trees are allowed to grow too large they cannot stand to support the lateral branches overloaded with fruit, besides preventing free ventilation, without which disease is generated.

As before stated, trees are propagated by seedlings and grafting. The best varieties are, of course, obtained from seedlings, and then grafted to the desired kind.

The orchards are pretty large in some localities, and small in others.

Maturity.—The age of fruiting is at eight years, giving the largest crop at twenty. The maturity of trees is from seventy to one hundred years, according to the soil, exposure, locality, and culture of same.

Insect Pests.—The insects damaging this beautiful plant are: *Il pidocchio del limone* (lemon louse), and *Il pidocchio dell'arancio* (orange louse).

The first one is an insect of a whitish color, which attacks both leaves and fruits. It made its first appearance in Sicily in 1862, and notwithstanding the several efforts to destroy it, nothing has as yet been accomplished to succeed.

The second, *pidocchio* (louse) of orange, is another insect of a dark brown color, and a very injurious one to both orange and lemon, by infesting the tree bark, leaves, and fruits.

Another insect, supposed to be the *Coccus aurantii* and a *Crittogama*, called *Nero degli agrumi* (black disease), first of a whitish color and then black. Both of them attack, also, the bark and branches of the tree, propagating on the leaves, blossoms, and fruits, causing the former to stiffen, turn yellow, and dry, while the latter grow very little, turning black, and never acquire the natural color of the ripe fruits.

If the parasite develops early in the season, the plant will thoroughly be covered with the disease, the fruit stops growing, gets black, and falls. It is said that petroleum sprinkled on the trunk and on the branches has proved somewhat of a remedy.

The *mosca* (fly) is another pest damaging both kinds of fruit. It generally appears in the beginning of summer, stinging the fruits and depositing therein its eggs, which develop into grubs which destroy the fruit.

The Gum Disease.—Besides those insects, there is also *il male della gomma* (gum disease), which greatly injures the whole tree if not prevented in time. It makes its first appearance with a small spot on the trunk, gradually enlarging to about one inch wide, and, in the course of four days, causes a crack on the bark, wherefrom a white yellowish liquid, like milk, drops out. Said liquid becomes thick and thicker, like small gum drops, and in a few days later they look like transparent yellow pearls.

According to Professor Cassella's experiments in his grove, where he has saved a great number of trees, to destroy and preserve orchards from such a disease, it seems the following methods are highly recommendable, viz.:

1. When a plant has been attacked, all the infested parts of the bark and wood are to be cut out, and care taken to destroy all the tissues affected by the disease, then take some quicklime, and while it is still warm rub all the wound, and especially the parts mostly infected. This done, cover the same to about one third of an inch thick with the same lime, *but cold*, and cover the whole with paper, or something else. Two

months later take everything off, and you will find the wood without any alteration.

2. To preserve the tree from the disease, mix nine parts of lime and one part of ashes, and dissolve the same like whitewash. Then dig a ditch around the tree, about three feet in diameter, by unearthing the largest roots of the tree, and pour into the ditch about thirty or forty liters (seven and one half or ten gallons) of the compost stuff; and with such a proportion for large, adult trees, treat the others according to age and size. In conclusion, to avoid such disease, for new groves bitter orange seed is recommended for planting, and then grafting at pleasure, as above stated.

Replanting.—On replanting young trees for final stay, as per experience had by several orange and lemon growers in this district, I understand that one of the most interesting points is the secret that when said planting is to be done, it is necessary to cut the end piece off the main root, about three inches long, for the reason that, if left on, it would draw all the humor from the ground, and would also prolong the growth and the trees to bear fruits. I may here give the total production of this fruit in the whole kingdom of Italy. Out of the twelve agrarian regions into which Italy is divided, only in two of them the acid fruit tree is not cultivated, that is, in Piedmont, Emilia, and a part of Lazio. According to a statistical report in 1880, by Professor Cassella, it seems that the total production of said fruit amounted to as follows, viz.:

Regione meridionale Adriatica	85,000,000
Regione meridionale Mediterranean	725,000,000
Regione meridionale Sicilia	1,622,000,000
Total fruits	2,432,000,000

VINCENT LAMANTIA,
Consul, Catania.

SICILY.

REPORT OF CONSUL WOODCOCK.

In this district, comprising the southeast third of Sicily, the land rises gradually from the seashore to the summit of Etna. The mountain is a little over two miles high, and Sicily is in a semi-tropical climate. The slopes of Etna, therefore, have every variety of climate from the semi-tropical to the frigid, according to altitude. Citrus groves make beautiful these slopes with their vivid green, from the seashore to an altitude of about one thousand feet. At this higher altitude the cultivation of the orange and lemon is not so profitable, owing to the uncertainty of a crop. Heavy frosts at such an altitude are liable to injure the buds. The fruit, however (called *Montagna*), is of the best quality.

The orchards that skirt the seashore bear abundantly, and seldom fail in producing a good crop. The fruit (called *Marina*) is inferior to the mountain fruit, and both trees and fruit are more subject to disease and pests.

The most desirable locality for a citrus orchard is that most distant from the sea, and not of such an altitude as to lie within the frost line.

Propagating the Plant.

There are four methods of propagating the citrus plant: by the seed, by cuttings, by grafting, and by budding.

The seeds for planting are taken from the choicest fruit when perfectly ripe, and are planted in the spring in some warm, sheltered spot, from four to five inches apart. The soil should be composed of loose earth and well rotted manure. The young plants should be sparingly but frequently watered. The plants must be transplanted to the orchard after the growth of a year or two.

To propagate by cuttings, young healthy shoots that are straight are selected. They should be about one foot in length, and must be planted in the ground to the depth of four or five inches, in a soil similar to that used for the seed. Care should be taken to plant the cutting upright, as it grew upon the tree. When the cutting becomes well rooted, and has had a healthy growth of a year or two, it may be removed for final planting to the orchard.

The grafting and budding methods, which are so commonly practiced, need not be described. Citrus plants in this part of Sicily are propagated almost entirely by the budding method.

For the stock upon which to bud use is made of the bitter orange tree. The bitter orange is indigenous to this climate. It is more hardy and less liable to disease than those that bear the choicest fruits. Its natural fruit has no value, but the Sicilians sometimes convert it into a kind of preserves.

For the purpose of propagating the choice fruits, the bitter orange plant is grown in nurseries from the seed. When the plant is a year old it is transplanted, and when it has attained a growth of about one inch in diameter (being three or four years old) it is again transplanted to the orchard.

Orchard.

The distance to be maintained between the trees in the orchard depends much upon the location and nature of the soil. When the locality is warm, and the soil is naturally rich, mellow, and of easy culture, the distance between the trees must be greater than when the soil is hard and the climate colder, because the trees will grow more luxuriantly and form larger tops. In such a soil, for lemons the plants should be about twenty-four feet apart, and for oranges about seventeen feet. When the soil is naturally hard and poor, and the climate colder, the distance between the trees for lemons may be about twenty feet, and for oranges about thirteen feet. The judgment of the horticulturist must determine this matter.

When the bitter orange plants are thus transplanted to the orchard, the tops are cut off about four feet above the ground. When they become well rooted and of healthy growth, they are budded from the choicest varieties of orange and lemon. Two buds are generally inserted in the stock, opposite each other.

The orchard is thoroughly cultivated, being worked over with the mattock and spade at least five times during the season, commencing in March and ending in October. The ground, when the trees are young, does not require so thorough a cultivation.

The plants are irrigated whenever they require it. For this purpose

the streams that tumble down from Etna are utilized. Where this is impracticable, water is elevated from wells by steam or mule power.

Some grow vegetables between the trees, but this practice is condemned by the best horticulturists.

As to the time when the trees begin to bear a full crop, much depends upon the climate, cultivation, and fertility of the soil. Generally they commence to bear a full crop when fifteen years old.

As to the longevity of the citrus tree, there is here a diversity of opinion. I have been told by some horticulturists that the lemon and orange budded upon a bitter orange stock will live and continue fruitful from one to two centuries. Doubtless they will live and continue to bear from fifty to one hundred years.

Lemon trees are healthy and vigorous, bear annually on the average about a thousand of the fruit, and oranges about six hundred. There are instances in which trees have borne ten times the number specified.

Gathering and Boxing the Fruit.

The time for gathering the fruit for export is here in the month of November. For export to so distant a country as America, the best and soundest fruit is generally selected. It is plucked when not fully mature, and is yet of a greenish color.

In gathering the crop great care is taken not to bruise the fruit. It is plucked by hand, and gently deposited in a basket that is lined with cloth. The stem is not removed from the fruit, but is cut off about a quarter of an inch from its base.

Great care is taken in preparing the fruit for market. Each individual fruit is carefully cleaned of all insects, or injurious matter, with a sponge and cold water, and is wiped perfectly dry before boxing. The fruits are carefully assorted. Those that are large, plump, and healthy in appearance, without marks or spots upon the surface, are boxed by themselves, and denominated "first class." Those whose skins bear any blemish, or otherwise are not fine in appearance, are boxed by themselves, and denominated "second class."

The boxes for the fruit are so constructed that they will hold from two hundred and fifty to three hundred and sixty of the fruit. Each box is inspected to see that no nail or sliver protrudes to injure the fruit. It is then lined with common silk paper. Each individual lemon is enveloped in the same kind of paper prior to being deposited in the box. The boxes are frequently opened, inspected, and all infected fruit removed. Especially is this done just prior to shipment.

Laborers in citrus orchards receive as wages from 30 to 40 cents a day, without food being furnished them. In summer they are required to work ten hours a day, and in winter eight hours.

The cost per annum of cultivation in the best orchards per hectare (2.471 acres), as estimated by a practical grower, Mr. Augustus Peratoner, United States Vice-Consul, is, on the average, 650 lire ($125 45).

Diseases and Pests.

The diseases and pests attacking the citrus trees in this part of Sicily are as follows:

A disease called the "colla" (glue) sometimes (though not often in this district) affects the citrus. It is said to be caused by a sudden

change from a high to a low temperature; this checks the exhalation of the tree, and the matter to be exhaled accumulates within until it bursts the passages and forces its way out through the bark. On coming in contact with the air, it condenses in drops of a light yellow gum. The only remedy for this disease is to cut off the branches infected.

A parasitic growth of a fungous nature frequently gathers upon the bark of the trees. The lemon tree is more subject to this than the orange. It is removed after a heavy rain, or after thoroughly soaking the parts affected, by scraping.

An insect called the *Pidocchio nero* (black louse) infests the bark, leaves, and fruit of both the orange and lemon; also, an insect called the *Pidocchio bianco* (white louse) infests in a similar manner the lemon tree. In appearance it is like a minute scale or scab, of oval form, and attaches itself with great tenacity to the bark, leaves, and fruit. This insect prevails to a large extent in our orchards. As a remedy, a wash of lime water is used; also, water slightly tinctured with kerosene.

The fruit of both orange and lemon is sometimes injured by an insect called the fly. It makes its appearance in the beginning of summer, and commences its devastation by stinging the fruit and depositing therein its eggs. These eggs develop into grubs, which destroy the fruit. When the fly first appears the fruit on the tree should be frequently washed. The water should be applied with a sponge. Some slightly tincture the water with kerosene or soda. Fumigating the trees with the smoke of sulphur has also been tried. No remedy has yet been discovered that effectually destroys the noxious pests. Good ventilation, thorough culture, and plenty of sunlight are the best preventives.

Exports to United States.

In the export of citrus fruits from Catania to the United States during the past three years, there has been a gradual decline. This is probably owing to the decline in prices. There were exported from Catania to the United States of lemons and citrons:

Years.	Boxes.	Value.
1882	241,107	$441,227 72
1883	228,857	324,284 84
1884	168,575	391,068 20

ALBERT WOODCOCK,
Consul, Catania.

CONTINENT OF AMERICA.

MEXICO.

GUERRERO.

REPORT BY CONSUL SUTTER, OF ACAPULCO.

Varieties.—Sweet and bitter oranges, navel oranges, lemons, limes, shaddocks, citrons.

Limes and sweet oranges are the most valuable. Some fifteen thou-

sand boxes of limes, representing for the growers a value of about $25,000, are exported annually, per steamers of the Pacific Mail Steamship Company, to San Francisco. Brought to town, selected, and packed for export, this fruit costs, more or less, $3 per box.

Only small quantities of oranges are exported to San Francisco per steamer from December to February, before the crop from the islands in the Pacific overstocks the market.

Oranges are obtained at $5 per thousand, but on account of high rates of freight cannot compete in the San Francisco market with the fruit imported from those islands.

Maturity.—Lime trees, which are allowed to grow like a bush, with branches rising from the roots, commence to bear at the age of four years, and are in full bearing when eight years old; in good soil, and with but very little care, the tree will attain the age of fifty years. This tree is indigenous, whilst the other varieties of the citrus family are said to have been imported.

Orange trees commence to bear at the age of five years; are in full bearing at the age of ten, and will remain fruitful fully as long as the lime tree.

Propagation.—All the trees are seedlings.

Insect Pests.—Ants are the only insects which are injurious to the trees; much more to the orange than to the lime trees. People protect their trees in various ways from ants with more or less success. The ants are destroyed by digging up their nests, or are kept off the trees with fine sand, fire, water, petroleum, etc. Fungous growth, and other parasites, are not found in such abundance as to seriously injure the trees.

Planting.—Most of the trees are planted very irregularly, in selected, favorable spots, which may keep moist all the year round. In a few newly laid out lime tree plantations, the distance between trees is twenty feet in every direction.

Situation.—Anywhere, mostly in moist places along small streamlets, or gulches, on the hillsides, in low bottoms along rivers, or near the seashore; in sandy, black loam they yield the best results; the sweetest and thin skinned oranges usually grow on hillsides, whilst the fruit of low lands is generally thick skinned.

Some orchards are in close proximity to the seashore, in sandy, black loam, in some instances, with lagoons of brackish water on the side opposite to the seashore, and give very excellent results. Thus situated, there is one newly, regularly planted, of eight thousand lime trees and one hundred orange trees, with room for many thousands more, and with the advantage of cheap transportation by water to Acapulco, the port of shipping.

Irrigation.—No system of artificial irrigation is in use; the ground between trees is not cultivated, but merely kept free of undergrowth and weeds, lands being as yet of but nominal value.

Yield.—As the orchards are not regularly planted, and the trees are scattered here and there, without any regard to economy in land occupied, it is utterly impossible to state even only approximately the yield or cost of cultivation of an acre per annum.

One orange tree, from the age of eight years up to fifty years of age, under ordinarily good conditions, will yield on an average three thousand oranges every year, worth, picked, $4 per thousand. A lime tree, from

the age of eight years to the age of fifty, bears fruit all the year round, and will yield about eight thousand per year, worth on the tree, say, $10.

Land being but of nominal value, no interest on capital invested in the same, or any ground rent, is to be taken into account; nothing is irrigated, consequently the cost of cultivation is very little, say, $150 per annum for an orchard of several hundred trees.

There being no export market for the other varieties of the citrus family, they are of comparatively little value, and only raised for home consumption.

JOHN A. SUTTER, Jr.,
Consul, Acapulco.

SONORA.

REPORT BY CONSUL WILLARD, OF GUAYMAS.

On receipt of circular, I addressed letters to several of the orange growers in the interior of Sonora (for at Guaymas but few oranges are grown), and in reply was informed that, as the cultivation of oranges as a business in Sonora dates back only a few years (since the Sonora Railway has been in operation, in 1882), they did not feel competent in giving a proper report.

I am told that the first plants or cuttings of oranges cultivated in Sonora were brought by the Jesuit fathers ninety years ago from Italy, and were planted at the Missions of San José de Guaymas and Hermosillo. But little attention was paid to their cultivation, excepting for home consumption, as there was no market for them on the coast (as they are grown from Guaymas to Panama), and no quick transportation existed to take them to a market north. After the Sonora Railway was finished, it furnished the means of getting them to a market in the United States, and in 1883 a small shipment was made, with good results, and since then orchards have been planted, and oranges now figure as an article of export to the United States by rail. In 1888 fourteen thousand boxes, of two hundred oranges each, were shipped. The fruit is sold on the trees at from $6 to $8 per thousand, being purchased by fruit dealers, through their agents, who pick, pack, and ship the fruit.

The Sonora orange commences to ripen in November, and by the end of December the fruit is nearly all harvested. Orange trees are grown along the seacoast and in the interior of the country up to three thousand feet altitude; those which have given the best results are from the sea level up to eight thousand feet. Bottom lands have been used for this purpose heretofore, but I am told some orchards have been recently planted near Hermosillo (inland one hundred miles from Guaymas) on rolling lands and hillsides. The trees are irrigated throughout the year, particularly in the dry season, which commences in October and ends in July.

The trees are raised from the seed of the sour orange and are set out or planted from thirty, forty, and sixty feet apart; the second year are grafted or budded with the sweet orange. They commence to give a small quantity of fruit the third year after grafting, and are in full bearing condition in the eighth year, yielding, if well grown, from one thousand to one thousand five hundred oranges per tree. No insect pests have appeared as yet to destroy the tree or fruit.

Lemons, figs, and olives are cultivated to a limited extent. This fruit from the few trees cultivated is used for home consumption alone, none being exported.

A. WILLARD,
Consul, Guaymas.

LOWER CALIFORNIA.

REPORT BY CONSUL VIOSCA, OF LA PAZ.

Varieties.—The Castillian orange (*Naranja de Castilla*) is the best variety known here for profit, supposed to have been introduced by the early Spaniards; of recent years seed and young trees, brought by fruit growers from the States of Sinaloa and Sonora, have been planted in different orange orchards, resulting in quite an improvement in the quality and flavor of the fruit over the old orange-producing trees in the country; other varieties are of limited production, such as mandarin, pear, and king orange, and of not sufficient quantity for export.

The citrus family comprises here six species fruitful and profitable for cultivation. Citron, shaddock (*Toronja*), large lemons, limes (*Citrus limetta*), lima, sweet lime, king orange, and *Lima chichona*, or sweet teat lime. This last fruit weighs commonly from twelve to fourteen ounces, and is very delicious. The king orange is the production of an orange tree, a young shoot grafted into a sweet lime tree, and in time from that to a shaddock or toronja, and, finally, a shoot from this last is again grafted on a common orange tree. Each of the orange fruit weighs from four to five pounds, and is of a very delicate and sweet flavor, and also exempt from acid.

Situation.—The locations where the trees grow are San Antonio, San José, and La Paz. San Antonio is fifty-six miles from the sea; the other places are ports of entry.

Elevation of the first named town, one thousand two hundred feet; the other two are in a level valley; all fully exposed to the sun.

Level land is best. The soil here is alluvial, sandy, and the subsoil within four feet under is of clay and gravel.

Temperature.—The average temperature is 85 degrees; minimum, 60 degrees; maximum, 93 degrees Fahrenheit. During winter nights are slightly cold, never warm, but quite warm during the day. In summer, sultry days very seldom, and the atmosphere generally very clear.

Rain commences in July and ends in October, in time to assist the growth progress of fruit.

Irrigation.—Irrigation is practiced all the year round. The citrus family have to be watered every three or four days, and give them as much water as possible.

Cultivation.—Young trees are transplanted in the month of September, and also in February, and the cleaning of trees takes place in December.

Fertilizers.—Cow and other manure is used as fertilizer, but in setting young trees a circular hole is excavated of four feet diameter and of three or four feet depth, and about a four-inch layer of old cattle bones is put down, and on the top of it another six inches of clay, and after another six inches of manure, and following common soil. The tree is set on the top of that. The best results have been obtained in that way.

Pruning.—First remove the inner superfluous shoots living at the

expense of the sap of the tree, and cut all other unnecessary branches to allow circulation of air. It is evidently proved that the tree should be allowed its full growth from ground. It is best either to protect it from the hot breezes, or from the heat of the soil, and even from frost, as generally the upper part only suffers, and the rest of the tree is fully protected.

Picking.—The picking of oranges takes place early in November, when they are just ripe enough for shipping. Oranges are cured by burying them separately under four or six inches of very dry sand, in a shaded and ventilated place, for a month or two; after that they can be taken out, will look proportionally fresh, and will keep in that condition for six months.

Packing and Shipping.—When packed for export, the oranges are wrapped in paper and packed in special boxes.

Planting.—Orange trees are planted twenty feet apart, lemons fifteen feet, and limes twenty feet. Orange trees are propagated by seed, shoots from roots, and by branch cuttings.

Some orchards are quite large and others are small.

Maturity.—Fruiting begins at five or six years from the time the seed is planted; when the tree is fifteen years old and upwards, it produces the largest crop of fruit. The full maturity of the tree is uncertain.

Insect Pests.—Trees here are very seldom troubled with insect pests, with the exception of some seasons by an insect in the shape of a tick, called *manteca*, which is very easily removed; but sometimes worms, in the shape of teredo on the roots, kill the tree beyond cure.

Picking.—The picking of lemons takes place in August and September, and curing goes through the same process as the oranges.

JAMES VIOSCA,
Consul, La Paz.

SOUTH AMERICA.

STATE OF BAHIA, BRAZIL.

Introductory.

I have the honor to report the following concerning oranges and lemons, as called for in the circular dated September 28, 1889:

As neither figs nor olives are grown here in the State of Bahia, nothing need be said of them. Very little attention is paid even to the cultivation of the orange or the lemon; so little that all that are grown are used in the place, none being exported even to adjoining States. The supply is so limited as practically to prohibit exportation, on account of the very high price that must necessarily be paid for them.

Should one wish to send a box of selected oranges to a friend in the States, he must pay for such box of one hundred, packed ready for shipment, 12½ millreas, equivalent to \$6 12½, and this in the orange season, too. Therefore, as none are grown except for home consumption, it seems quite useless to answer the questions in the order in which they are submitted.

Oranges.

Varieties.—The best variety is called *Lavanja de embigo*, or Navel orange. These oranges are seedless. When properly cultivated, they grow to a great size and have a most delicious flavor, being also very

juicy. It is not an infrequent thing to find oranges of this class weighing a kilo each, and often a little more, and measuring in circumference from eighteen to twenty inches. The orange of this class of ordinary growth measures from twelve to fifteen inches in circumference.

The other varieties, not choice, however, are *Lavanja de terra*, or Seville orange, which has rather a bitter taste, with seeds, and not as large, nor of course as fine a flavor, as the *Lavanja de embigo*.

Another kind is the *Lavanja de Cravo*, or *Tangerine*, similar to the Tangerine of Florida, with seeds. The fourth and the last class is the *Lavanja brabo*, or wild orange, with pips also.

Whatever cultivation is given, the Navel orange receives, though some attention is being given to the Tangerine.

Situation.—Anywhere along the seacoast. I have been informed they may grow anywhere, in fact, in the State.

As there is no land in the State that is cultivated that has any great degree of elevation, it may be said they will grow at any elevation.

Soil.—Clayey soil mostly about and in this city. Some sandy. In the interior of the State more of an alluvial nature. The character of the subsoil is presumably much the same as the soil. In most cases the subsoil has never been turned up. The land is never prepared by plowing it. The grass and weeds, when cut away at all, are cut by large hoes.

Climatic Influences.—Along the coast the mercury ranges between 76 degrees and 92 degrees in the shade. In the interior, especially on the higher elevations, the range is greater. Cool nights and very moist atmosphere. Rainfall in inches, I do not know. Generally the rainy season begins about April first, continuing to November first, though there are frequent showers in the dry season from November to April. Consequently, as the fruit is usually picked from May to August, it ripens in the rainy season.

Irrigation.—There is no irrigation.

Cultivation.—Consists simply in cutting the grass and weeds that spring up whenever needed, and is done, as stated, with a large hoe.

In a very few orchards the ground is seeded with grass, which is cut when green, after which the soil is loosened with the hoe, then animal manure is scattered broadcast through the grove.

Pruning.—Pruning is done after the tree reaches its fifth year, or thereabouts, say four to six feet from the ground. It is then continued every year thereafter while the tree has growth.

Picking.—This depends on the demand, as they are not shipped. People will buy them only when ripe, consequently they are allowed to remain on the tree till reaching the stage of ripeness.

Were the oranges to be shipped, the picking before being ripe would, of course, depend upon the length of time occupied by the steamer to the place of destination.

Planting.—The trees are planted from twelve to sixteen feet apart, and propagated by cuttings in Bahia. The orchards are very small generally.

Maturity.—The trees commence to bear in about five years. If the trees are properly cared for, largest crops are obtained from the eighth to the twentieth or twenty-fifth year in the life of the tree. Much depends, of course, on the seasons—whether very dry or very wet. They are fruitful for thirty or forty years.

Insect Pests.—A sort of white worm, which is destroyed by brushing

the trunk of the tree with a mixture of clay and water, or rather, painting it with the liquid mixture.

Lemons.

There are but two varieties of lemons in this State. The one called *Lima doce*, or sweet juice; the other *Limao*, an acid, nearly round lime. This lime is abundant, but is not cultivated to any appreciable extent. It is much more acid than the lemon proper, and is known, I believe, by the scientific name of *Citrus limetta*, the lemon being known as *Citrus limonum.*

As the limes are not shipped, there is no curing, no packing. They are picked whenever there is a demand for them, and, like oranges, may be obtained nearly the entire year, though, like the oranges, they are best in their season, which is the same as the orange season.

There are no statistics issued on the subject from any source. Prices of both oranges and lemons depend on the supply. The lowest price for the best quality of oranges is about 4 vintins, equal to 4 cents. The maximum price is about 8 vintins, say 8 cents. Lemons, or limes, may be bought from ten for 1 cent to one for 3 cents, depending on the supply or scarcity.

D. N. BURKE,
Consul, Bahia.

SPAIN.

MALAGA.

REPORT BY CONSUL MARSTON.

Oranges and Lemons.

Varieties.—The names of best varieties for profit are: China oranges and the Castillian lemons. There is another kind of lemon called the Reales, which is large and long, but the Castillians are more productive.

Location.—The trees that produce the varieties named above are grown in all parts of the Province of Malaga where there is water, and generally by the side of small rivers and streams.

The distance from the sea is about two kilometers, and the elevation above sea level one hundred feet. Any elevation, with water and sun, will answer. The more sun the better. Level land; sandy subsoil is the best.

Climatic.—Temperature, 45 degrees to 90 degrees Fahrenheit; average, about 78 degrees; nights immaterial. For both oranges and lemons, moist days, or ordinary atmosphere, are most beneficial.

No record of rainfall is kept in Malaga. Rainfall is always good for both trees and fruit.

Irrigation.—In summer only, three times a week, at any stage of growth, and as much as possible. Never water for ten or fifteen days before picking fruit.

Cultivation.—Twice a year, by plowing or digging around the roots.

Fertilizers.—Stable manure, placed around the trees to the depth of eighteen inches to two feet, in the month of January.

Pruning.—After four years old, begin to prune; height immaterial. If plowed with horses or oxen, then prune off lower branches; if you dig around the roots by hand with spade, it is immaterial.

Picking.—Picked when nicely ripe; for exportation, while they are green and before they turn yellow; nothing done to cure them here.

Packing and Shipping.—Packed in tissue paper first, and placed in cases one eighth, one fourth, and one third, and sometimes one half chests for shipment.

Planting and Propagating.—The distance the trees are planted apart is thirty-six feet; they are propagated from seed of bitter oranges, and grafted. The best varieties are seedlings.

The orchards are large and small.

Maturity.—Begin fruiting at four years of age; largest crop at about fifteen years; twenty-five years, full maturity.

Insect Pests.—Both lemon and orange trees, in certain locations, have been attacked by some kind of insect, but growers here are ignorant as to its name or nature.

There are parasites, but their names are not known; they injure the fruit by eating the buds.

Packing and Curing.—Never pick either oranges or lemons while wet, or immediateiy after rain; let them be perfectly dry. They are both hard and green when picked for exportation, and taken to the place of packing and there assorted as to sizes. The United States prefer the small, England and France the large, and north of Europe the medium sizes. They are then wrapped in fine tissue paper of different colors, and placed in rows in the case or box by women and girls, who are remarkably adept at the work. The package is then taken by men, the lids nailed on, and strapped with the ordinary wooden hoop-pole split in two pieces, branded, and then they are ready for shipment. The season for picking lemons is in September and October, and for oranges November and December of each year.

H. C. MARSTON,
Consul, Malaga.

PORTUGAL.

AZORES.

REPORT BY CONSULAR AGENT MOREIRA, OF ST. MICHAELS.

Varieties.—The name of best variety for profit is the common orange (*Citrus aurantium*), or China orange, which is the orange exported.

Names of other choice varieties worthy of culture are: the Selecta (selected) without pips, which never attains a deep color, and does not ripen well till March or April; the Tangerine, a variety of Mandarin, a delicious small orange, but not cultivated to any great extent; a few boxes are shipped, but of the Selecta hardly a package is exported.

Situation.—The trees that produce the varieties above named are grown in almost all situations of the island; distance from sea, from one half up to three miles; elevation above sea level, from eighty to four hundeed feet; for exposure to sun, eastern aspect desirable; they grow in all lands, but level land is preferable.

Soil.—Light soil, and also argillaceous mixed with pumice stone.

Climate.—Generally moist.

Temperature.—Winter months, minimum, 48 degrees; maximum, 75 degrees; average, 61 degrees. Summer, minimum, 50 degrees; maximum, 82½ degrees; average, 69½ degrees. Nights generally cold in winter but very warm in summer; few sultry days; atmosphere moist.

Rainfall averages forty inches per annum on the lower grounds, but on the higher lands probably sixty inches. Our soil is porous; the rain soon sinks into the ground and the soil soon dries up, therefore genial showers in summer are very beneficial. In some years there are droughts in summer, and the fruit trees suffer much, consequently the fruit is small and frequently rough.

Irrigation.—Irrigation not required.

Cultivation.—There is no particular method of cultivation.

Fertilizers.—About February lupin is sown broadcast, and when about two feet high is dug into the ground; some people (but very few) sometimes use farmyard manure, and guano has sometimes been applied.

Pruning.—Pruning is not generally practiced before the trees attain an age of seven years, and then at about four feet from the ground.

Picking.—Picking begins about the fifteenth of November and continues up to March; the fruit is not properly ripe until January.

Curing and Packing.—There is no system of curing. The fruit is packed in boxes containing from four hundred to five hundred oranges, according to size of fruit, wraped in Indian-corn leaves.

Planting and Propagating.—Distance from plant to plant, in rows, fifteen to twenty feet. If planted closer, which is sometimes done, the trees shoot up too high and the branches touch one another, preventing the sun from shining into the trees as much as desirable. The trees are now mostly propagated by selecting a healthy branch about half an inch in diameter, taking off the bark all around, about an inch in height, then putting around it some sifted soil. When it begins to throw out roots it is cut off from the tree and planted out in beds till it attains a height of at least three feet, and then it is ready to be transplanted. They are also propagated by layers, that is, by pegging down the lower branches and grafting in the ordinary way. From seedlings the oranges are better than from layers, but they take a long time before they produce any fruit. Sometimes, also, the trees are budded. The orchards are from one third of an acre up to twenty acres in size.

Maturity.—The trees will produce in seven years, not, however, in large quantities; but the largest crops may be expected when they attain the age of twenty years up to forty years, at which latter period they begin to produce less.

There are no insect pests.

Many years ago there was a fair quantity of lemons, and some were shipped, but now there are very few. Nobody ever thinks of planting lemon trees, except for their own use, or for sale in the market, where sometimes 5 cents are given for one. None are now shipped.

AUGUSTO S. MOREIRA,
Acting Consular Agent, St. Michaels, Azores.

OLIVE CULTURE.

ITALY.

REPORT BY CONSUL LAMANTIA, OF CATANIA.

Variety.—The common olive tree in Europe has oblong leaves, and is the kind which was first imported, and from the wild state reproduced in varieties, and grafted, offers so many varieties too difficult to mention. In fact, the Indians knew but one kind, the Egyptians only three, and the Hebrews and Greeks five. The Romans, as to Virgilius' statement, knew but three varieties; Cato says ten; Columella stated twelve; Macrobio reported fourteen, and Pliny declared fifteen varieties. In other times the botanic Tournefort classified them to seventeen varieties.

By an interesting report, however, published in 1871, by the *Ministro d'Agricultura, Industria, e Commercio,* it seems that there were registered three hundred varieties actually cultivated in the several regions of Italy, viz.: Lombardy, twenty-three varieties; Venetian, twenty-one; Liguria, twenty-four; Emilia, ten; Marches, sixty-three; Tuscany, thirty; Lazio, twenty-seven; Adriatic Coast, sixty-seven; and Sicily, twenty-one varieties. The olive tree in Sicily blossoms from the month of April to June, and experience has proved that when it happens in April, yields a full crop, while blossoming in May or June gives a scanty one.

The flowers on the bunches develop very slowly, but as soon as they fade the fruit sets on, and is formed in a few days. Ten or fifteen flowers compose the bunch, but only a few of them set on, and many of them fall down.

Bunches with three or four fruits stand well, and the fruits so formed come to perfect maturity from the month of October up to the end of March. The olive tree, when it is located in favorable conditions and cultivated properly, grows to an extraordinary size, very high, and lives very long. In fact, Pliny says that in his old times at Luiterno, a city near Rome, were seen trees which had been planted two hundred and fifty years before by Scipio the African. Gasparin writes to have seen at Rogliano, in the Island of Corsica, olive trees from seventeen to eighteen meters high.

Extraordinarily large are also several Saracen olive trees in Sicily, some of which Professor Aloi says yield as much as ten hectoliters of fruit. One of them, near Girgenti, which himself measured, has a circumference of eight and two tenths meters (twenty-five feet) at six feet from the ground. Their age, he further states, is from one hundred to one hundred and fifty years, while other authors agree to be from five hundred to six hundred years.

In some counties in the Province of Cosenza (Calabria), there are some olive trees, visited by Professor Aloi, which he judges to be of a very long origin, and some people of that country even pretend the said trees to have been from the time of Luigi D'Angio, who was sent there in a manner of banishment and to govern in the same time that country.

Vegetation.—In many parts of Italy this plant grows spontaneously, and principally derived from seeds deposited by some large bird's excre-

ments, which are in a condition of sprouting. But the plant left to itself grows and rises slowly from the ground, the branches furnish a few and small leaves, bearing very late, and the fruit yields but a little oil.

The olive tree propagated by seeds and subjected to grafting, when located in open air and on well adapted land, throws towards the ground a good main root, from which many others grow down deep, and the tree from its base acquires a majestic appearance. On points where the trunk joins the roots, on the largest of them develop certain swellings called *ovoli* (springs), which are used for propagating the culture. If the plant be destroyed by storm or killed by frost from its base, yet many shoots will come out, although less than when it is in the regular course of vegetation; these springs repeat their growing from the original roots.

The olive leaves last from two to three years, and grow matched on the branches one against the other.

Climate.—The olive plant is one of those generally liking warm climates, and in a changeable temperature it grows well, and fructifies even exposed to any direction. The extreme limit of its vegetation is marked about the 45th degree of north latitude. Excessive heat and intensely cold weather are injurious to its culture. In fact, beyond the African Atlantic the olive plant is seen no more. As Humboldt remarked, in his voyages in the several parts of South America, and as Poiteaux observed at Cajenna and St. Domingo, that if the plant could vegetate in those regions it would never bear fruit. Some writers have asserted that the olive plant wants to grow near the sea, and they have even established the extreme limit, beyond which, under this respect, the plant does not find the necessary conditions for its vegetation. This opinion has, however, been contradicted, and proved by the fact that many olive trees are seen growing and producing well in the interior of continents and very far from seashores. If the olive plant shows its preference near the sea it is because there the temperature is more suitable to its vegetation. The olive tree commences to vegetate when the temperature is at 12 degrees Centigrade above zero, and blossoms at 18 or 19 degrees Centigrade. A temperature of 5 degrees below zero, followed by a sudden thaw, operated by the sun's rays, is sufficient to kill it totally at the base. With a lower temperature, not followed by sunny days, the plant does not suffer as much, as it can stand a cold of 10 degrees Centigrade below zero. It is not so much the cold weather that injures the olive growth as it is the frequent change of cold weather to warm, and the often melting of ice.

One of the greatest enemies of the plant is frosty weather, especially when the snow fallen on the branches dissolves by the sun's rays, and congeals again during the coming night; at 12 degrees below zero it not only kills all the leaves, but even the trunk and its roots to the ground.

A cold of equal intensity is more fatal during the spring season than it is in winter, for the reason that the plants are then in a state of vegetation, and consequently the new sprouts are ruined and destroyed.

A cold in a vaporous atmosphere hurts more than in a dry one, and it is for that reason that with the same degree of cold the olive plants on plain lands, because in a vaporous atmosphere, become more damaged than those located on hills. The altitude where the olive tree can thrive varies according to the several regions in which it is cultivated. In

central north Italy, for instance, it ordinarily trespasses five hundred meters above sea level, while in Sicily it goes over seven hundred meters. But Professor Aloi assures me that he has seen olive trees in this island at eight hundred meters. It is proper, however, to note that if at the extreme limit of altitude the olive tree can vegetate, it is impossible there to bear fruit. Hence, planting in such localities does not pay. I may here give the agrarian climatic temperature in Sicily, which is divided into three different zones, viz.: the marine or warm climate, the medium or hilly temperature, and the mountainous or cold one. The height of the first is considered to be from sea level to six hundred meters above sea level; the second from six hundred to one thousand one hundred, and the third from one thousand one hundred to one thousand eight hundred meters.

The following table shows the several principal products cultivated and grown in same:

AGRARIAN CLIMATIC ZONE IN SICILY.

First Zone (Low Land, Warm Climate, from 0 to 600 Meters).	Second Zone (Hilly Land, Temperate Climate, from 600 to 1,100 Meters).	Third Zone (Mountainous, Cold Climate, from 1,100 to 1,800 Meters).
Olive trees.	Corn.	Prairies.
Vineyard.	Wheat.	Chestnut.
Sumac.	Horse beans.	Oak trees.
Fig trees.	Pistacchio trees.	Ilex.
Prickly pears.	Rye.	Pine trees.
Almond trees.	Barley.	Beech trees.
Oranges and lemons.	Chestnut trees.	
Cereals.	Filbert trees.	

Situation.—The success of olive culture greatly depends on situation and soil. Calculating the method of vegetation of this plant, it may be determined that, in warm climates, situations facing from east to north are to be preferred, so that the plant will not suffer from the summer heat. In climates less warm, however, an eastern exposure is best, and in climates of the last zone a southern exposure is best. As above stated, in climates less warm the expositions to east are to be preferred, but if the locality is subject to frequent white frosts, then it is better to cultivate it in expositions facing west and north, for the reason that exposed to the east the plants covered with white frost, and quickly touched by the morning sun, the sudden change from one temperature to another, they run the risk of getting dried.

As far as inclinations are concerned, those of hilly and rolling ones are to be preferred, for the reason that olive plants cultivated on flat land, although they present a flourishing vegetation, yield fruit too rich in oil, while those situated on hilly and rolling land give best results. The same may be said of trees planted in a mild temperature.

In flat land the fruit sets badly, becomes waterish, yields less oil and more dregs, is subject to fall before maturity, and is easily assailed by insects and disease. The trees on the highest zone of temperature suffer from the cold, and have, of course, less duration. It is, therefore, wise that in planting an olive grove preference must be given to middle altitude of hilly and rolling lands, without calculating the majestical aspect the trees may show on flat soils, for their fruit yields but a little oil.

Soil.—The olive tree is a plant which adapts itself to any soil, even

to the most sterile one; but it does not give everywhere the same quantity of fruit. In the soil it likes a certain coolness, but not exceedingly, for the reason that too much dampness, stagnated in the ground, renders it too hard, thus causing damage both to roots and trees.

The best soil for olive culture is the calcareous silico-argillaceous, rather deep and permeable. A stony soil, covered with a little ground, sufficient to let the young trees vegetate, may be adapted for the olive culture. The proofs thereof are the trees grown on the hills around Messina and on Mount Etna, which are covered with but a few centimeters of ground. In compact soil, and those on impermeable subsoil, the olive plant dies.

Fertilizing.—The manure adapted for fertilizing the olive tree must be subordinate to its composition.

From the analysis made by Duracher and Malaguti, the following has been obtained, viz.:

DESCRIPTION.	Potash	Soda	Magnesia	Lime	Phosphoric Acid	Sulphuric Acid	Flint-stone	Iron and Magnesia Oxide	Chloride of Soda	Chloride of Potash
In the wood	25.54	-------	7.23	20.12	10.15	3.43	13.75	4.43	12.16	1.26
In the leaves	26.67	-------	7.31	21.93	7.98	1.64	20.88	6.11	5.39	2.37
In the fruit	7.13	20.51	10.25	22.91	10.53	4.60	12.41	2.59	7.92	-----
Total	59.34	20.51	24.79	64.96	28.66	9.67	47.04	13.13	25.47	3.63

From the above table it seems that the olive tree contains mostly all the materials generally needed by other plants, and that lime, flint, and phosphoric acid are the most in proportion to other materials. Consequently, in manuring said plant the compost is to be made accordingly, in respect to others shown on the table. But many of said materials are contained in the soil, and in such cases it would be superfluous to add others. Therefore, it is necessary to learn the composition of the soil in order to know and to be sure how to properly manure the plants. Besides the above materials, well decomposed excrements of any animals, as well as wood ashes, etc., make also a good compost for manuring, and the proper time to do it is after the winter season, when, through the watering vehicle, the materials are absorbed in the ground. At last, in manuring the plants the material shown on the table must not be neglected, and of which potash, soda, magnesia, lime, silica, and phosphoric acid must be more in proportion, as such composts greatly benefit the olive culture. The quantity of manure to be given to each tree varies according to its size, quality, and composition of ground; and it is, therefore, impossible to establish a certain quantity, and the best thing to do is to manure annually with a little compost, except in cases where a plant shows dullness, when a good dose of manure could be given in order to make it revive again.

Propagation.—The olive culture can be propagated by (1) *semi* (seeds); (2) *ovoli* (springs); (3) *talee* (stocks); (4) *polloni* (sprouts); (5) *tronco vecchio* (old trunk); (6) *olivastrelli* (olivasters).

All the plants derived from any of those propagated must be grafted, as they generally grow from a wild state. Exception, however, is to be made in the case of young trees derived from stalks taken from the

upper grafted trees, or from plants which need no grafting, and those which are obtained from springs, sprouts, and old trunks.

Propagating by Seed.—This system, although requiring more time for growing and fruiting, as a method of propagation deserves to be appreciated, for the reason that plants originating from seeds are of longer duration, become larger, and better withstand cold weather, insects, and diseases.

To carry out propagation by seeds it is necessary first to prepare a good size seed plot, enough to contain all the young plants developing therefrom, and there to remain for three years, after which time they are to be planted in a reservoir for replanting. The seed plot must be exposed to the north, and the ground must be clear of roots and flintstones. In winter it must be richly manured with animal excrements, not quite decomposed, the ground deeply dug up, and always kept free of grass. During the spring and summer seasons it is necessary to keep it fresh, and water it whenever necessary to help the seedling to sprout. In July the young plants are out of the ground, and in November they are four or five inches high. During the second year the seed plot is to be worked the same as the first year, and in October, or in the coming spring season of the third year, the young plants are large enough to be transferred to the reservoir by taking off all the little branches therefrom.

Propagating by Ovoli.—The *ovoli* (spring) is a bud found on rooty stumps and on the larger roots. It has the shape and the size of a goose's egg, and shows out from the bark of trees. From each adult plant no more than three or four *ovoli* are to be taken off, otherwise you hurt the tree. To obtain *ovoli* or *talee*, instead of ruining many plants it is better to cut down one or two trees, from which a few hundred of them can be obtained for propagation. The said trees, however, must be of a good quality, apt to produce fruit of a white and juicy wood, and not reddish or veined. The springs on the roots are to be preferred to those located on the stumps of the trees, for the reason that the former are always more tender and juicy; hence, better adapted for budding.

Propagating by Talee (stocks).—This is simply done by cutting off from the best fruiting plants a bit of branch about one and one half feet long, which is laid in the ground by the largest end deeper down. The trees of the said stocks must be vegetating and of a large size, with thick bark, and well furnished with gems, wherefrom it is easy for rooting and budding. In order to succeed, however, it is necessary to lay it horizontally in a reservoir facing the same direction of its plant. Besides single talea, propagation can also be done by *talea composta* (composed stock), which, beforehand, needs to be placed in a temporary reservoir, and only when supplied with roots and buds is planted in another one. This method of propagating requires the identical work like the single talea, by placing it horizontally in the ground, the largest end deeper down.

After one year, the young branches will provide themselves with leaves and roots, when the stock will be cut in pieces and each piece planted in the reservoir.

Propagation by Polloni (sprouts).—Between the intersection of roots with the trunk of the largest roots on the base of trees, sprouts generally grow up, the same as in other plants, from which good advantage can be obtained in propagating the olive growth, as this is the quickest

mode of all. Very often, it seems, sprouts are provided with roots, and if they spring up in great number from the plant some are dug up, leaving the largest and most vigorous ones, and covering their bases with earth.

Propagating by Trouchi Vecchi (old trunks).—Advantage can also be derived from old trunks in the propagation of olive trees.

When a plant dies and contains living roots, you see a great number of sprouts growing therefrom, which are also useful for propagation, and for which use those most vigorous and largest are left on the mother plant, well covered with earth, and the smallest ones are taken out to let the former have more space. In this state of growing they are left until their young trunks grow as thick as one and one half inches in diameter, after which they are hoed up and detached from the mother plant, transported to the reservoir, and planted at the distance of two feet from each other. Where the sprouts of the dead plant are not many, then it is better to leave them attached to the same.

Propagation by Olivastrelli (olivasters).—Where the olive tree grows spontaneously in a wild state, and is not touched by animals' teeth, care can be taken of it until it grows to a proper size, when it is transported to final position, or planted in the reservoir, at a distance of two feet each side.

It is, however, worthy of note, that of all these methods of propagation, the one operated by seeds is the best, for the reason, as above stated, that plants so propagated live longer, and better resist the cold weather. In propagating by stocks, the character of the tree wherefrom stocks were derived is perpetuated.*

Grafting.—Following the propagation, I ought to proceed with the reservoirs, but as the small plants propagated by the methods above stated must be, in most cases, grafted, which can be done in the reservoir as well as in final stay, I proceed about the grafting in reservoir. Plants propagated by seeds, springs, and sprouts derived from grafting, as well as those from roots of trees already grafted, and those spontaneously grown by seeds in a wild state, need, of course, to be grafted.

The olive tree can be grafted by several methods, and they are as follows, to wit: (1) A *scudetto* (shield); (2) An *anello* (ring); (3) A *corona* (crown). The first method is mostly used in Sicily, on account of its simplicity and certainty; the second one is seldom used, because it is difficult, and it is operated late in the spring; the third one is practiced for adult plants, and likewise in the late spring season, when the plants are in a state of anger. Here I do not proceed minutely in describing the several methods, as grafting is well known by every agriculturist in the United States.

Treating Plants in Reservoir.—While the plants develop in the reservoir, it is necessary to predicate all the possible intelligent care, for the reason that if they are neglected they will be of poor fruiting production.

As to the length of time to keep them in the reservoir, several eminent agriculturists differ in their opinion, to wit: some propose five years, while others advocate fourteen. Practical observations, however, have proved that allowing plants five years in the reservoir, they can never acquire sufficient roots to be transplanted for final stay. On the

* Prof. A. Aloi's report.

other hand, if left for fourteen years, on the seventh or eighth year one half of them, the odd ones, are to be transferred to another reservoir, as the one would not be large enough to contain all the young plants located therein at a distance of two feet apart, as above stated. It is therefore advisable, in Professor Aloi's practical experience, that the proper time for allowing young plants in the reservoir is from seven to eight years, counting the time of the seed plot.

For the first two years keep the young plants clear of little lateral branches, but leave the leaves remaining on the arm pits. Fasten the little stock on sticks placed alongside with them, in order to protect them from strong wind or stormy weather. Water the reservoir in case of long drought, and fence it to prevent animals from destroying it, and always keep the ground clear of grass.

From the second to the fifth year treat the plants as above stated; only on the fourth year change the sticks for larger ones, in order to better sustain the growing plants. On the sixth year they are in a state for designating the shape you want them to grow.

The height of the trunks principally varies according to the situation of the ground wherein the plants are to be located for final stay. If the soil is fertile and fresh, they (trunks) can be left at about six feet high from the base, and if it is arid at about four feet. The reason for this is, that the shorter the plant the more vigorous they grow.

Having thus fixed the height of the trunks, all the young branches grown under them are to be taken off, and to the main sprout growing high must be done the same, and by leaving on its upper end about from five to eight branches well distributed around the same, in order to form the head of the trees.

Another method in fixing the height of them is by cutting all the branches off the plant to the fixed point of height, in order to permit its roots to develop and to incorporate themselves in the soil before the plant requires nourishment, and at the same time sprouts will grow to the desired height.

Transplanting for Final Stay.—We have learned up to this the sort of land and the exposition better adapted for the olive culture, as well as the several methods of propagation and the treatment to be given young trees in the reservoir. I now deem it proper to treat about the system of removing them therefrom, and the distance apart to be left between them. Further, I will proceed with pruning, and of the several insect pests and diseases afflicting the precious Minerva's plant.

When a grower is to transplant young trees from the reservoir to final stay, it is necessary for him to establish a plan, and decide whether he wants to exclusively form an olive grove, or together with plants of other fruits.

The disposing of planting in different manners is subordinated more to the inclination of the land than to the grower's faculty. The land may be too hilly or too flat. In the first case, it is better to plant all the land exclusively in olive groves, and in rows, for the reason that disposing them with plants of other fruits between they would yield less fruit; besides, rainfall on hilly soil washes out the necessary elements of their growth, and the roots of the other plants would always be exposed.

The several dispositions to be given to olive trees, and the inclination of the land, determine the distance apart between the trees. If a cer-

tain area of land is desired to be exclusively cultivated as an olive grove, the distance apart between the plants is to be such that, in the spring equinox, a plant must not shade the one standing by in the direction from south to north. For that purpose a distance of sixteen feet apart is sufficient. In a very rich soil, however, where the plant can grow very large, this distance must be doubled (thirty-two feet).

The inclination of the land for the grove properly adapted to the cultivation must be running from north to south, for the reason that if exposed to north entirely the culture would be retarded by cold weather.

Disposing the plants in rows, however, with the object of locating plants of other fruits between, the distance amongst rows must be thirty-two feet, and twenty-two feet between plants of the same row.

The best disposition to be given trees is the *hexagonal* one, for the reason that if it runs from south to east the plants will be in a position quite open to the sun, and will vegetate and grow well.

The proper time for transplanting from the reservoir to final location is in the month of July or August, when ditches, either round or square, of four feet wide by three deep, will be dug for planting the young trees taken from the reservoir, on hilly or rolling land. If the ground is flat, the ditches must be no deeper than eight inches, and if on inclining soil, sixteen inches deep. This done, throw therein some filling of old plaster or old mortar, with some stratum of good earth, wherein place the tree, with the roots well scattered around the base; cover the same with some earth again, manure over it, and some wheat husk or hashed straw to keep the soil fresh during the summer, and to nourish at the same time the tender roots. Shake the trunk a little, so as to allow the ground to be well settled between the roots, so that they will be easily rooting. After this operation has been done, cover carefully the ditches with the same ground removed therefrom. On the upper side, near the plant, form a sort of a little basin, so as to hold the rain water to water the same. In the summer, if a long drought should prevail, they must be irrigated.

Pruning.—An old motto in Sicily says: "He who works a growth demands the fruit; who manures it obtains the fruit; and who prunes the tree forces the growth."

The principal forms to which olive trees can be reduced are four, to wit: *At albero* (shape of a tree), *at pina* (shape of a pine), *at paniera* (shape of a basket), *at umbrella* (shape of an umbrella).

The first form is mostly used in Sicily, in Calabria, and in some parts of the Roman and Tuscan provinces. It consists in leaving the tree take its natural habit, the pruning being limited by cutting off now and then all the dried and broken branches, and all those deviating the humor from the central trunk. The form *at pina*, called also "cone," is more correct than the former, and consists in allowing the branches to be disposed in a shape without hurting one another, thus forming a good exterior without exceeding leaves.

Pruning *at paniera*, called also *vaso* (vase), consists in taking from off the main trunk all the disfiguring branches, to make the tree look in the shape of a vase. The olive plant so pruned appears with all its branches well ventilated, and, therefore, besides producing the great quantity of fruit, it furnishes them completely matured. For this reason, pruning *at paniera* is considered as the most advantageous one, and the same is

generally used in this island. Finally, a good pruning must be based upon the following principles, viz.:

(1) An olive plant produces no fruit on new sprouts before two years' time, for the reason that said sprouts in the first year bear no fruit, but simply develop and bud fruiting gems; in the second year, when they will grow larger for blossoming, setting, and fruiting.

(2) The blossoms do not set, neither produce fruit, if not exposed to the sun's rays during the longest part of the day. This fact must not be neglected by the pruner when he applies his pruning knife, if he wants to gather the fruit. He must always prune so as to let the fruiting branches be exposed to the sun, so that its rays will penetrate through the plants, as those thickly loaded with branches and leaves not pruned as above stated bear less fruit than the former.

It is necessary for growers to keep those facts in mind, if they would succeed in this culture.

(3) The horizontal and bending down branches produce a great many fruit, while the vertical ones bear none. The pruner must consequently turn his attention to raising the plants as above stated, and not in a vertical shape.

(4) When a plant has a great number of bearing branches, the fruit will naturally be small, yield less oil, and the crops will be biennial. To avoid this the smart pruner should simply leave a certain number of the most vigorous branches—enough so as not to force the plants—for by so doing they will render larger olives and more oil every year.

(5) The olive trees being of so many varieties they consequently require different treatment. To keep in mind the several varieties of olive plants while pruning is going on, it must be indispensable for the pruner to know that there are some branches tending to grow up straight, while others incline downward. In the first case the former are not to be forced to grow low in a close shape, but simply prune them yearly, and try to prevent them from growing too high, and allow them to retain all the lateral branches except the dried and faded ones.

(6) The olive plant, according to the ground, its exposition, and the height where it is located, vegetates and bears fruit differently. The quality of the soil has a certain noted influence on the vegetation of the olive tree. If the soil is argillaceous and too rich of vegetal and fertilizing matter, then little pruning is to be done, for the reason that the quantity of strength the plant draws therefrom permits it to maintain a large number of branches. If, on the other hand, the soil is poor—that is, loose silico-calcareous—then it is necessary to cut many branches off, for the reason that the little sap the plant draws from the soil is not sufficient to nourish many of them.

(7) The plants must be divided into three categories, according to where they are located: (*a*) All the plants on argillaceous rich soil of the warm zone; (*b*) all the plants on calcareous soil of the middle temperate zone; (*c*) all the plants on the poor siliceous soil of the high cold zone.

In conclusion, a good pruning consists of (*a*) suppressing all branches tending to grow up straight, as they are very exhaustive; (*b*) cutting down all the parts from the plant, all the dead branches, as well as those broken by the wind, and those growing longer than others; (*c*) suppressing all the sprouts developed in the plant during the year, leaving only some terminal ones, and some others grown near those having

the force to bear. If many new sprouts were left on the branches, the majority of them would fail to bear, because the sap the branches draw could not nourish them all. Pruning in such a manner that the plants would grow in proper form, the branches should be well disposed without confusion, and the lower ones bending down would cover a part of the trunk. Another operation essential for the pruner to know is that if the trunk contains dry bark, knotty and partly detached from the wood, he should cut it off with a well sharpened tool, for the reason that in so doing he cleans the trunk from insects, wherein they lay their eggs. Another advice to the pruner is, that following the years in which the plants bear much fruit, it is always better to shorten them a little, as it is proper to leave others longer, which during the years produced less.

In conclusion, following the rules above stated, the pruner can be sure of his success, provided, however, he will, with sharp eye, carry them on in accordance with the above instructions, always taking into account the local climate and condition of the soil. These rules and modifications are the results of long experience.

Insect Pests.—The olive has the most fearful enemies, which attack it in every way most terribly; in fact, insects, diseases, and inimical causes, more or less, make a slaughter of it.

Arrayed in first line are the insect pests attacking the fruit, while others attack the wood and the leaves, thus hurting it in every way. The most terrible is the *Mosca dell' olivo* (olive fly), or *Daco delle ulive*, known as *Musca oleæ*, *Dacus oleæ*, *Cynips oleæ*, *Stronomus keironi*.

The Dacus is a small fly, about half the size of a common fly. It is an insect with orange yellowish colored head, green eyes, yellow breast, with two black points. The female Dacus has on the extremity of its abdomen a sheath of black color, wherefrom it throws an arrow, piercing the fruit, wherein it deposits its eggs. This insect is so pernicious to the olive culture as to shorten two crops out of three. It works as follows:

As soon as the olives are formed the female Dacus throws its arrow, pierces the olive skin, shakes its wings, and into the pulp lays one egg. This done, the insect takes a rest by cleaning its body as a sign of satisfaction, and then flies away to other olives to perform the same operation, until it deposits from three hundred to four hundred eggs into as many olives. From the egg, in a short time, you see a certain soft whitish larva without feet, which, staying fifteen days in the pulp, digs a vertical gallery through till it reaches the stone, and diverges thereby.

As soon as the larva is fully grown, it gets near to the out fruit by enlarging the canal made by its mother on depositing the egg, so as to let the grown insect come out.

Twelve days from the time the larva is transformed in nymph, grows the fly, and the insect is formed in twenty-eight days, counting the time from depositing its egg.

The *Cocciniglia* (female Coccus) is another insect damaging the olive tree, which stays for several months immovably attached on the branches and on the leaves. When in a state of reproduction it lays thousands of eggs, seeming as excrescences of the trees. The male Coccus looks different from the female.

In the month of May the female lays about one thousand eggs, which it covers and then dies, thus protecting the future progeny with its corpse.

The eggs under such protection open one month later, and precisely in June, giving life to larvæ which develop in the bed formed by the mother skeleton.

The Coccus, attached to the branches and leaves of the tree, not only sucks its juice, but prepares the tree for conditions favorable to the development of a fungus called *Antennaria olæophila*, *Cladosporium fumago*, or *Torula oleæ*, which darkens all the plants with black, and makes it look lurid-like.

In Sicily the olive plants are often invaded by the Coccus, and more especially on coasts fronting the African Sea.

According to the Gasparin and Roches method of destroying the insects, it seems that sulphur sprinkled on the attacked plants, as it is done on the vines for the *Crittogama*, is a good remedy.

La Tignuola (*Tinea oleæ*) is also an enemy to the olive plant. This belongs to the *Lepidottera* family. Its butterflies are very small, with grayish wings, and mostly marked with whitish spots.

The evening moths, which ordinarily come to our house to die, burned at the candle flame, are Tignuola. The grubs are very small, voracious, and cause immense damage. Their generation is as follows: In the spring seasons these insects, derived from the first generation, produce eggs, wherefrom grow larvæ, which voraciously devour the branches and sprouts of the olive tree. When it commences fruiting, the Tignuola reproduce for the third time, after which they deposit their eggs at the base of the fruit, wherefrom new larvæ come out, and stay there until they are in metamorphosis, and as long as the fruit remains on the tree.

The *Punteruolo* is a "Coleottero" belonging to the section of *Xilofagi*, and its botanic name is *Philojotribus oleæ*. It also causes much damage to the olive tree.

Another small Coleottero, *Rosicante dell' olivo* (olive eater), is the so called *Hylerinus oleiperda*, a dark colored insect covered with hair. The larva is white, and nests under the bark of the tree, and sucks the life of the sap branches in the cell which it digs, accomplishes its transformation, and flies away when perfected, about the month of May. It then joins the female, which, having been impregnated, goes upon the branches, which it wounds to deposit an egg, which forms a larva, as above stated. To destroy the said insect some people propose to cut off the perforated branches from the tree, while others recommend, as soon as the insect attacks the plant and weakens it, to manure it, plow and water the same, so as to make it revive again.

La Cantaride (*Cantharide vescicantoria*) is another insect belonging to the Coleottero order, tribic of the *Coleotteri vescicanti*. From the deposition of the egg and its transformation into a perfect insect it undergoes five stages, but only when it is perfected does it damage the olive tree.

La Cantarides appear in the month of June in extraordinary number, when they dart in flight on the olive trees, feeding on the tender sprouts and blossoms, and thus not only destroy the present crop, but even the one of the succeeding year. The Cantharides are very common in continental Italy, but not so numerous, while here in Sicily they cause heavy damage. These agriculturists, however, perform an efficacious method as the only one to destroy the terrible Coleottero. It consists in shaking the branches early in the morning, and precisely when they

are asleep, to make them fall on sheets expressly placed under the trees. Thus gathered, they are then sold to apothecaries for making blistering plasters.

La Psylla dell' Olivo (*Psylla olivina*) as well as *l'Afide* (*Aphis adonis*) form a sort of a white down under the armpits of the branches and leaves. The *Aphis abide* under the same, feeding on the humor of the trees, which become sickly, and sometimes die, if the infected branches are not cut off at once. The said aphis—well known in the United States, for I remember my boys used to catch them on trees on Canal Street at New Orleans—is also another dangerous insect to the precious plant. The same is destroyed with lye or lime. The Psylla, when in the state of larva, encircles itself in a sticky whitish matter, and causes the plant to droop.

This disease is generally called here *Malattia del cottone* (cotton disease), and the most energetic remedy is to treat the plant by cutting off all the infected branches.

Finally, the *Caszo perdilegno* (*Coccus legniperda*) is the more terrible insect, damaging the wood. The Coccus, when in a grub state, is bloodish red on top, and white-yellowish under. The butterfly deposits án egg in the bark, wherefrom grows a grub, which bores into the tree—into the heart of the tree—killing it at once; if the tree is young, the Coccus is assisted in its work of destruction by a special liquor of a strong odor, secreted by the insect itself, which softens the wood fiber. This terrible insect is difficult to be destroyed. It lives three years in a state of larva, and the butterfly is found in the spring and summer; consequently at such a time it is necessary to use a certain activity to destroy it. The naturalist, Professor Boisduval, advised the municipal authorities of the infected places to "offer one lire of reward for every Coccus caught, as a good remedy to destroy the same."

Diseases.—Besides the said insects there are also diseases to which the olive plant is subject, such as: (1) *Il Chiodo o Rogna* (the nail or scab), the cause of which is by some growers attributed to insect punctures, and by others to the imperfect assimilation of the juices, which, instead of alimenting the plant, accumulate at certain points, producing deformed excrescences.

Il Chiodo (nail) generally dilates in olive groves propagated by *ovoli* (springs), and greatly prevails where the forced method of propagation has been practiced. The extravasation may be caused by wounds produced by hail, or by the bark cracking while the plants are in active vegetation, or by the ill treatment to the bark while gathering the crop. The cause most common, however, is excessive pruning.

(2) There is *La Fungositá vascolare* (vascular fungus).

(3) *La Lupa* (she wolf), which is a very cancer to the plant, which, although its exterior is sound, it is rotten within, permitting the rain to enter and lodge in the interior.

The lupa may be apparent or not. It is necessary to extract it and thoroughly cleanse the infected part with a sponge saturated with a soap wash.

(4) *Lo Screpolo* (gap) is caused by excessive heat or cold. The gaps caused by the former are superficials, and are also cured with the same wash.

Among the parasitic plants hurtful to the olives are noted the Muschi

(musks), the Licheni (lichen), and the Borracina, which establish themselves in the bark of trees, on which they live in part.

The production of musks and lichens is due to the dampness abounding in some olive groves, or on account of the quality of the soil, or little ventilation. To free the plants, therefore, from it, it is necessary to scrape them with a well sharpened spatula, and brush the infected part with whitewash on a winter day, but not cold or rainy.

Besides those there is also *Il Mal nero* (black disease), which is produced by fungus, botanically known as *Antennaria olæophila*, *Cladosporium fumago*, which sometimes causes the plant to sicken and die. Its multiplication is due to presence of the *Cocciniglia;* hence, by destroying the Coccus you free the plant from the black disease.

Frost and strong winds are also enemies to the plant, and the damage which the former causes may be known only in the month of April or May, just at the time when it can be partly remedied. Sometimes it happens that through intense cold the plant dies at the base. In that case, if it is over thirty years old, the plant must be cut off near the ground so that new springs will grow therefrom, some of which will take the place of the dead plant. A long draught is also hurtful to the olive culture, for the reason that the plant loses its leaves, its vegetation is checked, and it yields no fruit.

Strong winds may also ruin the plants by breaking the branches or dislocating them. Finally, were I to mention other insects, diseases, etc., it might have a depressing effect on the California growers. Consequently, I deem it proper to remind them that notwithstanding all the said insects, contrarieties, etc., in this island of Sicily, in an area of one hundred and four thousand five hundred and eighty-five hectares of olive cultivated land, it yields an annual production of seven hundred and thirty thousand two hundred and thirty-eight hectoliters of oil, at the rate of seven hectoliters per hectare, a good paying industry, besides many quintals of pickled and dried olives for home consumption and for foreign markets.

Therefore, I exhort the California agriculturists to go to work and dedicate themselves earnestly to the culture of that most precious plant, the olive tree, by repeating to them the celebrated Columella's motto, "*Olea prima omnium arborum est.*"

VINCENT LAMANTIA,
Consul, Catania.

CONTINENT OF EUROPE.

FRANCE.

REPORT BY CONSUL TRAIL, OF MARSEILLES.

The Olive Tree in the South of France.

The olive tree (*Olea Europea*) is common to the whole of the south of France, and when nearing the south by rail the traveler can at once detect its familiar green color and its regular shape. For miles it can be seen on either side, sometimes in an uncared for, almost wild state, and sometimes in well cared for, well cultivated, regular plantations. It grows in almost any soil, in rocky or stony ground, and even without

attention produces fruit that is a small, though uncertain source of income to the poor peasant, but when well cultivated and attended to becomes a certain revenue to any farmer who takes the necessary care and trouble.

The olive tree is essentially the tree of warm climates (it is said to originate from Egypt), but not of tropical heat, therefore the Mediterranean district suits it admirably. It succeeds well in places where the mean temperature of the year is from 59 degrees to 61 degrees Fahrenheit. It does not support heat above 104 degrees, nor cold below about 15 degrees. Frost below the latter freezes and kills all the branches, and one is obliged to cut the whole tree down to the ground and wait till it has grown again. It is the greatest calamity that can befall an olive tree, for it takes about ten years to regain its former position, and even then it is often far from being as good. In 1820, almost all the olive trees in this consular district were killed by frost, which was ruin to thousands, oil being then twice the value of to-day.

The olive tree is also essentially the tree of dry, stony, hilly, and undulating ground. Some of the hills and mountains along the coast are covered with olive trees, and inland plains are so planted with them; but the fact must be mentioned, too, that in some districts, notably around Toulon and Hyéres, olives are being rooted out of the plains and vines planted in their place. Calcareous ground is favorable to olives for fine oil; sandstone, schist, and granite soils are less favorable. When the soil is rich the tree itself prospers and grows to a great size, but the fruit is less abundant and inferior.

The best is a mixed, fairly dry, red or calcareous soil, with exposure to the south. The ground must not be too dry nor too moist. Of the two evils, a too dry soil is to be avoided most. Drought is unfavorable to olive trees, as the olives dry and fall off before they have attained maturity; but a good rainy winter or spring suffices to give enough moisture for the following summer. After a very rainy winter season an olive tree will stand excessive heat much better than after a dry one.

Now, olive trees uncared for and left to themselves produce, under favorable circumstances, a light crop about every two years, sometimes oftener even, and sometimes, under favorable circumstances, less frequent; but cultivated and well cared for it becomes an interesting, important, and highly profitable branch of agriculture; one can count upon fairly regular annual crops, and the result is generally satisfactory. The importance of olive growing in countries that suit cannot be over estimated.

In the south of France, and all around the Mediterranean, the olive plays a part in domestic economy of which little is known in other countries. It can be seen on the rich man's table as a relish, or its product, in the form of salad oil or frying oil, is used daily in his kitchen; and a handful of plain olives form at certain times the daily meal of many a poor peasant and farm laborer. In countries and districts where butter is scarce and dear, olive oil, in some form or other, is used in almost every dish that comes upon the table, and a fact that is not generally known is that, in the south of France, olive oil is even preferred to butter for frying purposes.

Varieties.

There are many varieties of olive trees, and many that have simply changed through change of climate, soil, or care, but the chief ones cultivated in this district are these:

(1) The Brown olive tree, a slow growing, hardy tree (especially against cold), that gives few crops, but usually abundant ones. The olives are of a darkish hue, fairly good for pickling, but less good for oil. This variety used to be grown very much, but is less cultivated now.

(2) The Cayon, or white olive tree, a quick growing, small tree, with low branches, is sensitive to cold, but grows again quickly after a frost. It produces olives in its third or fourth year already, and gives a crop pretty regularly every two years. Its olives are reddish, and produce good oil that retains the taste of the olive, a fact that is appreciated in these districts. It is largely cultivated around Marseilles and Toulon.

(3) The Pendoulier, or high growing olive tree, a good sized tree, with large branches that frequently hang down. It produces a good crop rather late in the season, pretty regularly every two years. Its olives are of a dark hue, and produce very fine, tasteless oil, that is much appreciated for export, and which is almost exclusively used in the perfumery trade. This variety is largely cultivated in the Grasse and Nice districts.

The two latter kinds are excellent varieties for profit, and are recommended for general purposes. In many respects the Cayon is preferable, chiefly because, being a lower and smaller tree, it requires less room and is easier to attend to. Its height is usually from twelve to sixteen feet. They can be planted at a distance of, say, fifteen or sixteen feet apart each way; thus, from one hundred and fifty to one hundred and sixty would go on an acre. The Pendoulier, being a much larger tree, requires about thirty feet square to itself in order to fully develop; thus, about forty would go on an acre.

Cultivation.

The cultivation of the olive tree is very simple, and it is this that makes it pay. The chief points are digging, fertilizing, pruning. The ground ought to be well dug up around the tree to at least six feet from the stem, and if possible, kept loose throughout the rainy season. A good plan is to dig a trench around the tree, and on sloping ground, to connect these trenches one to the other by ditches, all to be closed up when the wet season is over. No irrigation is then necessary. Artificial watering would only be called for in spring if the whole winter had passed without any rain at all—a circumstance that rarely, if ever, happens.

Fertilizing.

Fertilizing ought to be done at the same time as digging, that is, during winter and spring. In places and farms where stable manure is obtainable at a reasonable price, it can be used to considerable advantage; in towns, and in the proximity of oil mills, the refuse of these mills is a good fertilizer, and the dirty water that comes from the mills can be used, mixed or diluted with pure water. Powdered oil cake is an excellent stimulant, and ought to be well mixed with the earth. Finally, the dead leaves that fall off from the olive tree itself, and the small branches cut off when pruning, well dug into the ground, are

largely used as fertilizers, and are by no means to be despised. Strong fertilizers must not be used too frequently.

Pruning.

The question of pruning is one that requires study, as it depends a great deal upon circumstances. An olive tree usually gives a crop every second year, therefore it ought to be pruned every second year, and then, of course, shortly after the gathering of the crop, say during January and February. But as cultivation in many cases makes the tree produce a crop every year, it is right in this case to prune the tree slightly every year. When the trees are pruned every year, it must be done carefully and lightly; in fact it must only consist of a slight thinning out. The chief thing to be borne in mind when pruning is, that those twigs that have blossomed and produced fruit once, never do again; therefore, that pruning must consist in cutting away useless twigs and branches to give light and air and make room for fresh and fruitful twigs and shoots.

Pruning depends in a great measure, too, on the position and exposure of the trees. Olive trees exposed to high winds ought to be kept low and rather compact, but those in favorable positions, on sheltered hillsides, for instance, can be allowed to grow larger. Thus it will be found that olive trees along the shores of the Rhone, and, indeed, in all the Rhone Valley exposed to the pernicious "mistral," are little more than bushes, and are kept as such; whereas, toward Toulon and further on, also in Tunis and other parts, the olive tree grows to a great height and size and is pruned accordingly.

Picking and Curing.

The blossoming of the olive tree takes place in April and May, and if the rains have been favorable and no frost occurs the crop may be considered sure.

The gathering of green olives, for pickling, is done from about the twentieth of September to about the tenth of October, and must be done by hand. The date of gathering depends, of course, upon the stage of the fruit, as it ought to be done just when the olive has reached its full size, and before it begins to turn black. Green olives cannot be eaten as they come off the tree, because they are too bitter, but are pickled by the very simple process of soaking them in brine or very salt water. Sometimes ashes are used as well as salt. As soon as they have almost lost their bitter taste they must be taken out of the brine and put into clear water, if possible running water, and washed.* They are then ready to be packed in kegs, barrels, bottles, or jars, but with a little salt water, or water highly seasoned or aromatized, and are fit for export, for storing, or for immediate use.

Black olives for pickling are gathered, as their name indicates, when they are black, say during November. The pickling process of these is left to Nature, *i. e.*, they can be simply spread out on wicker-work hur-

* The usual way in which green olives are pickled in this district is as follows: They are soaked in a solution of potash and water (one pound to one and one half pounds of potash to a gallon of water) for about two hours, then put into clean water, which is changed once or twice a day until the water remains clear. After this the olives are ready to pack in salt water for keeping.

dles or basket-boards, exposed to the sun and wind till their natural water has evaporated, and with it their bitter taste. They can then be eaten in their natural state, but are more palatable well seasoned with salt, pepper, and oil.

The gathering of olives for the manufacture of oil must take place when they are black and quite ripe; generally from the end of November to the end of January. They can even be left to fall to the ground and then gathered up, but as they do not all fall off together, it often takes a long time to gather in the complete crop. Care must be taken not to let them rot on the ground, as such olives would spoil the oil for table purposes. A good plan is to wait till the first good fall has taken place, and then to set about gathering in the whole crop, either by shaking or picking off all the rest. Care and attention must be exercised when gathering in the crop for oil-pressing in not picking them before they are perfectly ripe, and also in not breaking off the young branches that will produce fruit the next year. In positions favorable to the ripening of the olives, that is, where the olives on any one tree ripen almost simultaneously, the trouble of gathering in the crop is rendered easier by stretching out coarse sheets or cloths under the trees, and simply shaking or pulling the fruit off the branches into them.

Now, in order to obtain olive oil of superior quality, there are several primary conditions to be observed. Care should be taken in selecting only sound olives, and picking out all bad ones and foreign substances, such as stones, dirt, leaves, or anything that may have been gathered along with the olives. For superfine oils, it is therefore advisable to press olives that have been gathered by hand only, or, at least, shaken into cloths.

Once gathered, the olives should be looked over, selected and separated, and taken to the mills with as little delay as possible. They should not be left in heaps or in baskets for any length of time, as they are liable to ferment, which is detrimental to the obtaining of really fine oil. In some old-fashioned places peasants pretend that this fermentation facilitates the pressing out of the oil, and even increases the quantity; but this idea is not to be recommended, as the slight gain, if gain there be, in quantity is more than counterbalanced by the difference in quality.*

Cleanliness in the mills is a great point. It is essential that all presses, millstones, casings, recipients, be perfectly clean, so that no bad taste nor color can possibly be given to the oil during the process of manufacture.

The simplest and the primitive way of manufacturing oil consists solely in placing the olives in a mill in which one or two millstones are revolved either by hand, by oxen, or by horses, until all the oil is crushed out. But this altogether primitive and imperfect mode can only be seen now in country places, at great distances from cities and villages, in Algeria, Tunis, and in some parts of France. It has long since been supplemented and superseded by other more perfect and complete processes.

It is, however, seldom that a farmer or olive grower presses his own olives. In centers and districts of olive cultivation there are generally one or more oil mills to be found. Proprietors of oil mills can be

* This custom of allowing the olives to ferment before putting them into the oil presses is still observed in many parts of Spain, and for this reason Spanish olive oil is generally of an unpleasantly strong taste.

divided into two classes, viz.: those that are simply oil crushers, who crush the olives and make the oil for the cultivator who brings his crop to them; and these are paid in kind, *i. e.*, they are not paid in money, but by agreement retain a certain percentage of the olives brought to them. This system often gives rise to certain abuses that are difficult to suppress, and the poor peasant frequently finds that he has been very far out in his calculation of the quantity of oil that his crop ought to have produced. The other class of oil mill proprietors is composed of those that may be called merchant crushers. These buy olives in large quantities from the growers and dealers, manufacture the oil, and sell it themselves. There are several large manufacturers in the city of Marseilles who possess mills in several different centers of olive cultivation in this district, and in Algeria and Tunis. These firms have very naturally acquired a certain reputation for their several marks, and many can command higher prices in the market on the strength of their reputation. Each manufacturer professes to have a special method of his own, but the basis is the same for everybody. The only difference that can exist is in the way of filtering and refining or clarifying the oil before it is finally casked or bottled.

Olive Oil Manufacture.

The process of manufacture is as follows: The olives ready to be pressed are first put into a mill, similar to those formerly used for the whole operation, but the olives are only half crushed, and no oil is crushed out, so that they form a shapeless mass. This mass is then distributed into round flexible kinds of baskets (French name, *Scourtins*) made of sparto grass and horse hair, something in the shape of short sacks with mouths only half closed, containing about fifteen pounds of the crushed olive mass. From ten to twelve of these bags are then placed, one above the other, in a pile under the regular oil press, and in such a way that the base of one bag rests on the open mouth of the one below. The mouth of the bag being smaller than the circumference of the bag, the mere fact of placing one above the other closes them. At the base of the press there is a ledge with an opening on one side, below which the recipient for the oil is placed. When all is in its place, the press is set in motion, in small mills by hand, in large ones by steam, and the oil gradually oozes out from all sides of the baskets and flows into the vessel below.

The oil that flows from this first pressing is the best, and is called virgin oil (*Huilè vierge*).

When no more oil flows through the baskets, the press is reversed and the crushed and hard mass of olives is taken out. This hard and apparently dry mass still contains a good quantity of oil, of good, ordinary quality for kitchen purposes, and in order to obtain it, the mass must be broken up and mixed with boiling water. The warm mass or pulp is then placed a second time in the baskets, and the whole is pressed in the same way as the first lot, only, during the operation of pressing, boiling water is frequently thrown over it. The oil and water that flow from this pressing are received and left to stand in large stone vessels or metal tanks, and the oil that gradually mounts to the surface is the second quality of oil.

Now, the mass that is found in the baskets after the second press is

either stored to dry and sold as oil cake, or is sold to special mills that extract a third quality of oil by means of acids and other agents. But this quality cannot be used for table purposes; it is, however, very good for the manufacture of soap, and is largely used in this and other industries.

The oil that comes from the first and second presses is not generally sold in its primitive state, but is refined and filtered, and it is in this process that some manufacturers excel above others. The principle of refining and filtering consists in letting the oil remain for a few weeks in tanks or immense jars, during which period a sediment gradually deposits itself at the bottom, and then passing the oil, minus the deposit, through filtering papers specially prepared and sold for the purpose. Some manufacturers even pass their superfine oil through specially prepared cotton-wool, which is certainly an expensive process.

After being filtered, the oil is ready to be casked or bottled for consumption.

Adulteration.

In many places adulteration is carried on to a great extent, and refined cotton oil is largely used to mix with olive oil. Cotton oil being from 20 to 30 per cent cheaper, and being tasteless, lends itself very advantageously to the adulteration of olive oil. It is an open secret, too, that vast quantities of pure cotton oil are shipped and sold as olive oil to those markets that prefer tasteless oil. Cotton oil is, however, used under its own name by many people who prefer a tasteless oil for frying purposes.

Résumé.

From the foregoing, it will be readily understood that olive growing and oil pressing are two distinct professions, and that they are better if kept separate. This explains the existence of professional oil crushers, who do nothing but press oil for the growers; otherwise, unless a grower had a large amount of capital at his disposal wherewith to work a mill and pay the necessary staff, he would never be able to attend to the digging, fertilizing, and pruning of his olive trees with due care, as this ought to be done just at the same time of the year as the all important first-oil pressing.

The olive grower, if he attends to his task properly, has plenty of work to do, and the more he does the better he is repaid. As already mentioned, an olive tree left to itself will produce fruit, but one well cultivated will repay its owner tenfold. Though it does not pay to be too lavish in expenditure, yet an outlay of about $50 per acre per year is considered a sound investment in these regions. Considerably less is spent by many a grower, but if one has the courage to lay out about the sum mentioned, one can generally depend upon being well repaid.

A full grown Pendoulier, well fertilized and cared for, will produce about thirty gallons of olives in a crop; very large and fruitful trees have been known to produce up to one hundred gallons even. A full grown Cayon, under the same circumstances, will produce from seven to eight gallons in a crop, and there are many that can produce twenty gallons.

The value of olives varies according to crop and quality, but, roughly speaking, about $1 per gallon is the average price.

The out-turn of oil varies according to the quality and condition of

the olives, but the average yield is 14 per cent by the two pressings, plus 10 per cent by acids, say a total rough average of 24 per cent.

The olive tree, well cared for, is almost always free from disease and parasites, but it is well to be on the look out for any possible enemies. The branches are sometimes covered with a kind of yellow moss, produced in some instances by too much dampness or moisture, and in others by weakness of the tree. In the first case the ground must be immediately drained, and in the second it must be manured. In both cases it is well to cut off the branches so covered. Sometimes there is no remedy, and the trees must be rooted out, and the ground used for other purposes.

Sometimes a sort of cochineal, the Coccus, attacks olive trees, and in this case a hard brush, dipped in vinegar, is the best remedy.

The *Tinea oleæ* occasionally attacks the leaves, and the *Hylerinus oleæ* occasionally kills the buds, but these are not serious foes. Of all insects that is most to be feared is a fly that deposits its eggs in the wood of the olive; it is the *Dacus oleæ*. The larvæ of this fly eat away and destroy whole branches, and it is extremely difficult to exterminate them. The best way to destroy them is to scrape the branches and apply boiling water or a solution of lime, but even these are not always effectual. Nature, however, sometimes helps herself, and not unfrequently another insect, the Cynips, deposits an egg in the hole bored by the Dacus, and the larva of the Cynips kills and feeds on that of the Dacus, thus saving the tree.

The olive is a tree that attains a great age, and that with care is said never to die. It can, however, be reproduced by cuttings and by seedlings that must be grafted the second year.

CHARLES B. TRAIL,
Consul, Marseilles.

WINTER PROTECTION FOR THE VEDALIA CARDINALIS (AUSTRALIAN LADYBIRD).

The Executive Board at its meeting, August 14, 1890, resolved unanimously to at once erect two glass houses covering large orange trees where the destructive cottony cushion scale (*Icerya purchasi*) can be thickly colonized, and at the approach of inclement weather place a few of the *Vedalia cardinalis* in one of the houses, reserving the other for later use, should the first become overstocked. In this manner the Board hopes to preserve this wonderful insect to the fruit growers of California.

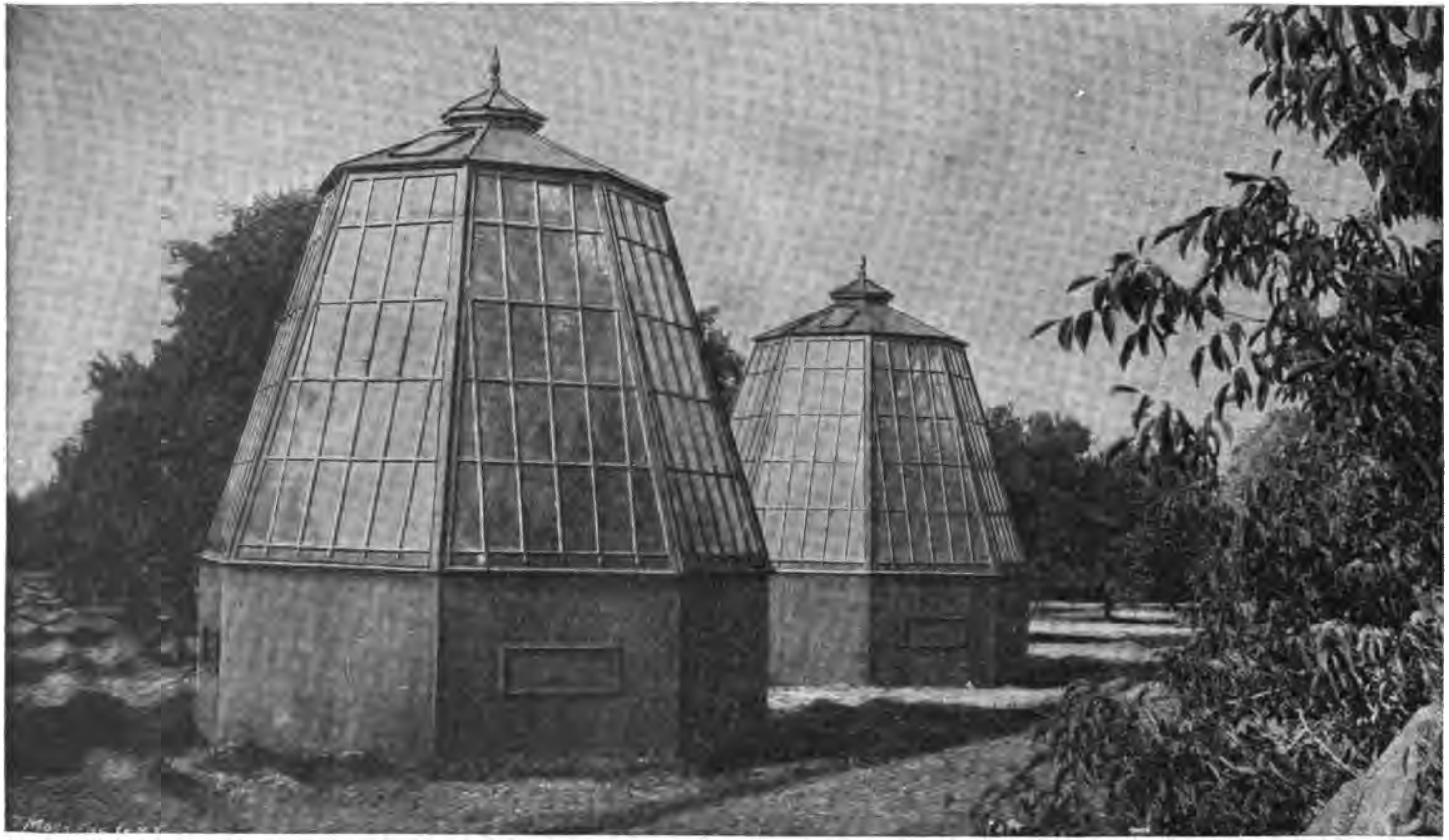
This course was prompted by the experience of last winter. In the spring it was almost impossible to find a living specimen; but the cottony cushion scale reappeared in a number of groves where it was supposed to have been exterminated, having passed through the winter under the ground at the collar of the tree, under a weed, or in some other way secure from the attacks of the Vedalia. At the approach of warm and congenial weather the scales hatched and developed with such rapidity, that it created considerable alarm among orchardists.

The experience of the past few years was too fresh to again allow the scale to become established. In consequence of their reappearance the Board was in almost daily receipt of letters making application for a colony of the ladybirds. Fortunately, several colonies were placed on trees (in 1889) late in the fall in warm localities, where they passed the winter. The Icerya is now very scarce, and the possibility of the Vedalia passing through the winter months is now reduced to a minimum. The Board has had erected at San Gabriel, Los Angeles County, two glass houses, a good idea of which can be had by reference to the accompanying photo-engraving plate. They are octagonal, and so designed that they present a good surface to the sun, and thereby warmer and more suitable for propagation of both scales and ladybirds.

The dimensions are each sixteen feet in diameter by eighteen feet in elevation; every part is well fitted, and the ventilation protected by very fine brass wire mesh, to guard against the entry of any ladybirds before the cold weather sets in, otherwise the scales would be destroyed by them early in the season; and also to prevent the ladybirds from escaping during the time they are being colonized for distribution in the spring.

Many are of the belief that this most important foe to the baneful Icerya "has come to stay," but there are no facts upon which to base such an opinion, beyond the fortunate results of the past winter, when they passed through it unprotected. There is too much at stake, and the risk of them dying out too great to allow this to be again repeated. It is to prevent all possibilities of a failure that these precautions have been taken.

WINTER PROTECTION FOR THE VEDALIA CARDINALIS.



Glass Houses, Covering Large Trees, Built at San Gabriel for the Colonization of Parasites and Predaceous Insects.

IMPROVED FUMIGATING APPARATUS.

In our previous reports are to be seen the various appliances then used for the destruction of scale insects (principally the red scale upon citrus trees), by the use of hydrocyanic acid gas. Since then many new inventions have been put into operation, and have served the purpose well to some extent, but on the main, they mostly consist of the general ideas embraced in the various apparatuses as illustrated.*

In the past year, however, more improvements have been made, no doubt due to working with the first built, which were, in many respects, cumbersome. The most approved apparatus now in use throughout Orange County is the one herewith illustrated. The description given, brief as it is, well serves the purpose. There is no patent upon it, and it can therefore be constructed by any one who may choose to do so. The plans are correct, and are appended in a form that will require no drawings or plans for their construction.

FORMULA FOR GENERATING HYDROCYANIC ACID GAS.

The method that has given the most satisfactory results is the following:†

It consists in using one part, by weight, of dry or undissolved potassium cyanide, with one part sulphuric acid, and two parts water. The generator is made of lead, and is somewhat in the form of a common water pail. After the tent is placed over the tree, the necessary quantity of the dry cyanide is placed in the generator, the proper quantity of cold water added, and the generator placed under the tent, near the trunk of the tree; the acid is then added to the materials in the generator, a barley sack thrown over the top of the latter, after which the operator withdraws, and a quantity of earth is thrown upon the lower edge of the tent where it rests upon the ground, to prevent the escape of the gas. After the expiration of fifteen minutes the tent is removed and placed upon another tree.

The following table will aid in determining the proper quantity of each ingredient in treating orange and lemon trees:

Height of Tree—Feet.	Diameter of Tree—Feet.	Cyanide of Potassium—Ounces.	Water—Fluid Ounces.	Sulphuric Acid—Fluid Ounces.
10	8	2¼	4½	2¼
12	10	4½	9	4½
12	14	8¾	17½	8¾
14	10	5½	11	5½
14	12	7½	15	7½
16	14	12	24	12
18	14	15	30	15

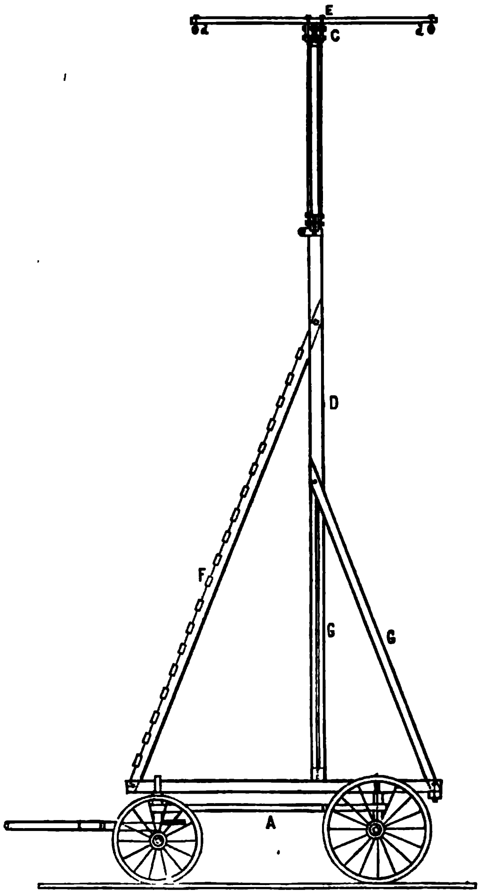
It will be noticed that the proportions are one ounce, by weight, of the cyanide to one fluid ounce of the acid and two fluid ounces of water, or in the proportion of cyanide *one*, acid *one*, water *two*.‡ This being borne in mind, it will be easy to ascertain how much acid and water to use when once the proper quantity of cyanide required for treating any given tree has been ascertained.

*Biennial reports, 1885–6, 1888.

†Prof. D. W. Coquillett, "Insect Life," Vol. II, Nos. 7-8, 1889.

‡ In the report made by Alexander Craw, found in this volume, he gives the following as the proportions: Two and one quarter ounces cyanide of potassium (by weight); two

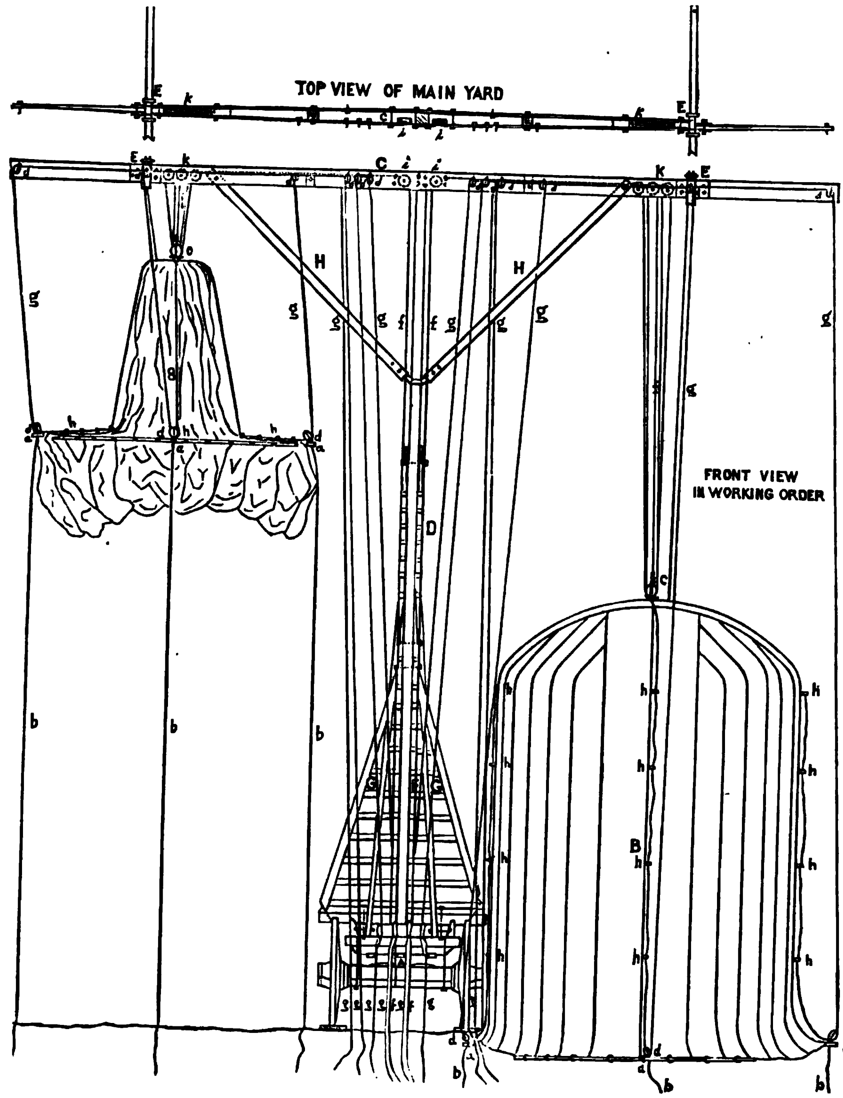
IMPROVED FUMIGATING APPARATUS.



SIDE VIEW OF FRAME.

DESCRIPTION.—*A*. Wagon. *B*. Tents (2). *C*. Main yard. *D*. Mast. *E*. Crossbars (2). *F*. Ladder. *G*. Mast stays (6). *H*. Main yard truss (2). *a*. Trail boards (8), to bottom edge of tents. *b*. Guide lines (8), one half inch diameter to trail boards, thirty feet each. *c*. Six-inch blocks (2), double sheave, for hoisting tents. *d*. Four-inch blocks (20), single sheave, for hoisting trail boards. *e*. Belaying pins (4), galvanized iron, to fasten ropes. *f*. Main ropes (2), three quarter inch diameter, for hoisting tents, one hundred and ninety feet each. *g*. Trail ropes (8), for hoisting sides of tents, one half inch diameter, one hundred and twenty feet each. *h*. Rope thimbles (32), one half inch diameter, galvanized iron, for trail ropes of tents. *i*. Six-inch sheaves (2), brass, in main yard, for hoisting tents. *k*. Five-inch sheaves (6), brass, in main yard, for hoisting tents.

IMPROVED FUMIGATING APPARATUS.



Scale: One quarter inch to the foot.

FRONT VIEW IN WORKING ORDER.

NOTE.—These drawings represent the apparatus built by S. W. Preble, Esq., of Tustin City, Orange County, Cal., and is used in his orange grove. The measurements were taken on the spot by J. A. Shilling. The apparatus, attended by two men, worked most perfect in all its parts.

By using the cyanide dry we are saved the trouble of first dissolving it; the dry cyanide is also easier to transport and safer to handle than the solution is, and if the vessel containing it should be accidentally overturned on the ground, the dry cyanide will not be lost, as it certainly would if dissolved. By thus using the cyanide dry it is not necessary to first pass the gas through sulphuric acid in order to render it harmless to the trees, thereby saving a great deal of labor, and admitting of the use of a much simpler and less expensive generator. By placing the latter beneath the tent there is less liability of the gas escaping while being generated and introduced into the tent from without, thereby also insuring the operator greater immunity from inhaling the gas. I also found that by thus placing the generator under the tent, the blower heretofore used for distributing the gas inside of the tent could be done away with, thereby still further reducing the original cost of a fumigating outfit, besides doing away with the labor necessary in operating the blower. The time during which it is necessary to confine the tree in the gas has also been reduced one half, as compared with that heretofore allowed for destroying the fluted scale (*Icerya purchasi*, Maskell), thereby rendering it possible to treat twice the number of trees in a given time that could be treated in the same time by the old process. I found by experiment that about five minutes were consumed each time in generating the gas. The treatment with hydrocyanic acid gas is the only method known to me whereby the scale insects located upon the fruit can be destroyed by a single operation. My own experience, and that of every other person with whom I have conversed upon this subject, and who has had any considerable experience in the matter, indicates that no liquid preparation at present known will, by a single application, prove fatal to more than 90 per cent of the number of red scales located upon the fruit; and when it is remembered that the Supervisors of many counties in this State have passed laws making it a misdemeanor to sell or expose for sale fruit infested with scale insects, the value of the gas treatment to our fruit growers is made apparent.

The following is an account of the experiments I made with hydrocyanic acid gas as referred to above: The trees operated on were all of them lemon trees containing fruit, and were in a comparatively healthy condition, although very thickly infested with the red scale. Before making these tests, I had the experimental tent painted black, and am strongly of the opinion that when a tent of this color is used the foliage of the trees will be injured less when by inadvertence, an overdose of the materials has been used, than would be the case if a light colored tent were to be used; the light rays, more than the rays of heat, serve to decompose the gas, and, on this account, any medium that will intercept the rays of light will, in a great measure, prevent the decomposing of the gas. In all cases where a blower was used for distributing the gas inside of the tent, the gas entered the blower direct from the generator and was forced into the lower part of the tent through a tin pipe, and the pipe which conducted the air and gas from the tent to the blower, also entered the lower part of the tent and then turned upward, terminating near the top of the tent. By this means the gas and air in the upper part of the tent were drawn out, and, after passing through the blower, again entered the lower part of the tent. This was for the purpose of more thoroughly circulating the gas inside of the tent; but, as will be seen by the later experiments, this arrangement was found to be entirely unnecessary when the generator was placed under the tent. In nearly all of the later experiments too large a quantity of the materials was used, resulting in more or less injury to the tree or fruit, the injury being always the most severe on the topmost portion of the tree. The cyanide solution used in a few of these experiments consisted of five pounds of cyanide dissolved in one gallon of water, each fluid ounce of the solution containing an ounce by weight of the cyanide. The diluted sulphuric acid was composed of two fluid parts of the acid and three of water, and was allowed to become cold before being used.

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and one quarter ounces sulphuric acid (fluid ounces); water, three fluid ounces. Professor Coquillett, in a very recent communication, says:

"In using the materials for fumigating, it is best to add the water first, then the acid, and last the cyanide. The acid is heavier than the water, and when added to the latter becomes thoroughly mixed as it sinks into it.

"Two and one quarter ounces of cyanide require two and one quarter fluid ounces of acid, and four and one half fluid ounces of water, instead of *three* ounces of water, as you have it. This will be sufficient for a tree ten feet high and the top eight feet in diameter."

ACKNOWLEDGMENTS.

Our thanks are especially due to Captain J. D. Young, Superintendent of State Printing, through whose aid we have been able to issue our numerous reports, etc., without delay, and upon a much improved style and arrangement over those previously issued. Our thanks are also due to Hon. Ira G. Hoitt, Superintendent of Public Instruction, to Prof. D. W. Coquillett, of Los Angeles, to Mrs. Leonard Coates, of Napa, to Prof. E. A. Weed, Entomologist Ohio Experiment Station, to Hon. W. W. Morrow, and to Messrs. S. Rae & Co., of Boston, for very kind assistance received at their hands. We also desire to extend warm and sincere thanks to all through whose generous aid our many investigations have been brought to a successful termination.

Very respectfully submitted.

B. M. LELONG,
Secretary.

APPENDIX A.

REPORTS OF THE COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS.

REPORTS OF THE COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS.

REPORT OF THE LOS ANGELES COUNTY BOARD.

The horticultural interests of Los Angeles County have made rapid strides during the past year, and at this date are prosperous and encouraging far beyond anything in the county's history.

The area planted to citrus trees in this time has more than doubled the amount in existence at last report. The short crop of deciduous fruits in the Eastern States has opened up such an active and paying market for our products that it is a great incentive for their future culture, and will result in the planting of an immense acreage the coming season.

Through the personal efforts of this Commission, assisted by the Inspectors, we are able to give an almost accurate census of the fruit trees in the county, with a result far more satisfactory than ever before attained. They are classified as follows:

Orange seedlings, ten years and over	259,038
Orange seedlings, under ten and over five years	24,378
Orange seedlings, five years and under	20,261
Orange budded, ten years and over	68,611
Orange budded, under ten and over five years	123,689
Orange budded, five years and under	491,115
Seedling orange in nursery	1,642,315
Budded orange in nursery	788,409
Orange trees growing in seed bed	4,446,600
Lemon trees bearing	37,106
Lemon trees not bearing	29,524
Olive trees	170,654
Olive trees in nursery	336,594
Acreage of deciduous trees	12,629
Deciduous trees in nursery	287,075
Walnut trees	110,626
Walnut trees in nursery	12,900

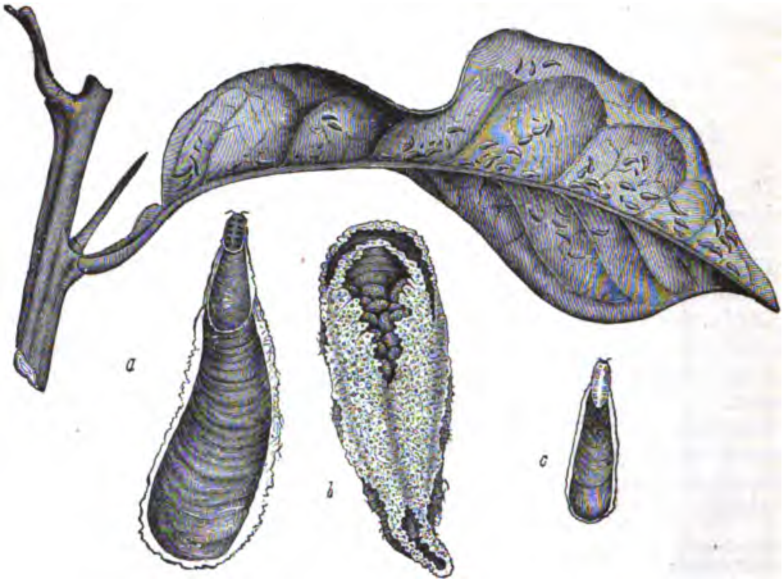
Making a grand total of 22,851,482 trees now in orchard, 3,067,298 in nursery, and 4,446,600 in seed bed.

The Commission has not relinquished its efforts toward eradicating the many insect pests that are ever present with the horticulturist.

As far as the white scale (*Icerya purchasi*) is concerned, the past remarkable work and present existence of the Vedalia in sufficient quantities, gives a feeling of perfect security against any further ravages of a once dreaded pest. The yellow (formerly known as red) scale (*Aspidiotus citrinus*) has, under some influence not yet explainable, decreased in such numbers, and in a few localities entirely disappeared, that up to the fifteenth of August there were bright hopes entertained that it would ultimately vanish before another year. The insect, however, began to show signs of an increase on the date mentioned, and although not in such vast numbers as heretofore, it is still with us. It is interesting to note that the young are not locating on the fruit, only in isolated cases, and scarcely any seem to possess the life and vitality that has been noticeable in former years.

PURPLE SCALE.

Mytilaspis citricola, Packard.



BRANCH INFESTED BY THE SCALES (NATURAL SIZE ON LEAF).

[A purple scale generally found throughout the State of Florida. It resembles ***Mytilaspis pomorum*** (oyster-shell scale), which is common in many places on old apple trees. In Florida it is a very troublesome pest. (*a*) Scale of female from above. (*b*) Same from below, showing eggs. (*c*) Scale of male. All highly magnified.]

The San José scale (*Aspidiotus perniciosus*) has increased in the past year to an alarming extent, nearly every variety of deciduous tree being attacked by it. With the great interest renewed in fruit culture, aided by public sentiment fast molding, the Commission feels confident that this dread pest will be kept in check.

The same causes will undoubtedly serve to rouse up orchardists to the necessity of a warfare against the codlin moth—an insect that is fast gaining a foothold in nearly every pear and apple orchard in the county. The rejection of such infested fruit by canneries and driers this year, with big prices staring them in the face, will serve as an "object lesson" that even the dullest horticulturist can solve.

The brown soft orange scale (*Lecanium hesperidum*) has appeared in such numbers during and since the spring months, as to cause serious alarm. It appears to affect young trees mostly, literally covering them, giving the whole tree a brown appearance. In past years this insect has not been considered dangerous, appearing in the spring in small numbers, but soon disappearing.

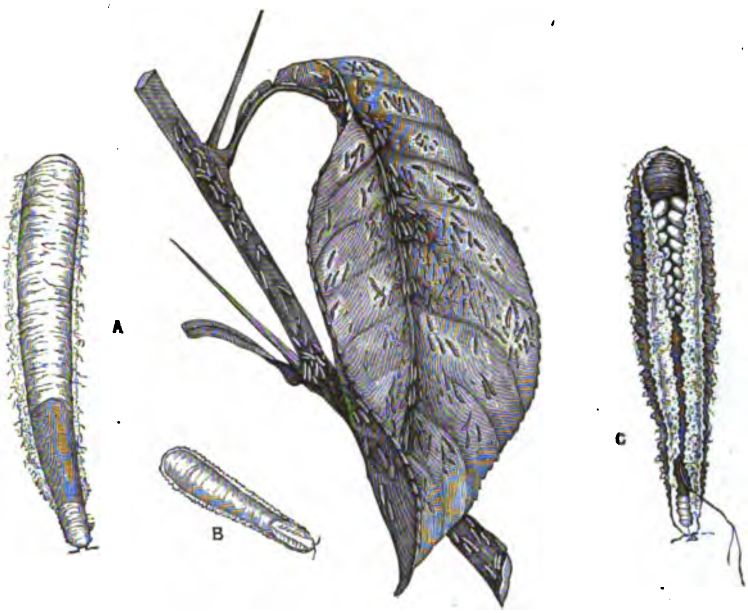
In certain localities great trouble has been experienced this year from the large increase of black scale (*Lecanium oleæ*). The Commission has succeeded in arousing a proper sentiment regarding this pest, and a general warfare is being waged, with most encouraging results.

The brown apricot scale (*Lecanium*—unnamed) appeared in great numbers during the spring months, seeming to prefer prune trees, caus-

ing considerable uneasiness. The warm sun of summer has caused it to almost entirely disappear.

LONG OR GLOVER'S SCALE.

Mytilaspis Gloverii, Packard.



BRANCH INFESTED BY THE SCALES (NATURAL SIZE).

[A light yellow scale varying to dark brown; resembles *Mytilaspis citricola*, but is much larger. (*a*) Enlarged. (*b*) Scale of male, enlarged. (*c*) Female scale and eggs, enlarged.]

The several scales imported on Florida trees demanded much of our attention during the planting season. [We append illustrations of those most liable to be introduced, and in order that they may be more easily identified.—SEC.] The *Mytilaspis Gloverii*, or long scale, and *Mytilaspis citricola*, or purple scale, have been quite generally found together. The *Chaff scale* was also introduced on Florida trees, but in no case has this Commission found this scale propagated in this county. The first two mentioned have been closely watched, but only in one instance found alive on trees planted over one year. In this instance the long and purple scales were both found, the trees having been planted eighteen months, but were undoubtedly imperfectly disinfected before planting.

The Commission has used the utmost vigilance in causing all Florida trees to be disinfected by both dipping and gas treatment. The red scale of Florida (*Aspidiotus ficus*) has been introduced on imported trees, but was without doubt eradicated by the gas treatment which the trees received. This Commission is of the opinion that these four pests introduced from Florida are a serious menace to the citrus industry of the State, and nothing has as yet been adduced to convince us that it is either safe or wise to ignore the danger with which we are threatened. All purchasers of Florida trees should, in justice to the community, as

well as to themselves, use every precaution, and aid the Commissioners to the utmost in their efforts to disinfect all imported trees before planting.

This Commission feels greatly encouraged in the results of its efforts to rid orchards of insect pests. In the case of scale that infests citrus trees they recommend first the gas treatment; if that is not applicable, then the spraying with the resin emulsion. For pernicious scale, the wash of lime, sulphur, and salt. All of these remedies have been found effectual when properly applied.

FLORIDA WAX SCALE.

Ceroplastes floridensis, Comstock.

BRANCH INFESTED BY THE SCALES.

[A white scale which appears in and throughout Florida. Has not yet made its appearance in this State, and care should be exercised to prevent its introduction; and in order that parties importing trees or plants may be able to identify it, this description and illustration is given. (*a*) Young female. (*b*) Adult female, enlarged.]

BARNACLE SCALE.

Ceroplastes cirripediformis, Comstock.

[A small barnacle-like scale. The figure represents a branch infested with the scales. (*a*) Female, enlarged.]

In contradiction to our annual report of last year, the seedling orange trees will yield this year nearly a full crop, while the budded orange trees will yield hardly one third of a crop.

The yield of deciduous fruits this year has been immense, while the prices obtained by orchardists for their products have been correspond-

ingly large. The number of deciduous trees that will be planted out the coming fall and winter cannot be estimated, but it will be greater than ever before, provided the supply equals the demand. It will naturally follow that such an increased demand will result in the importation of eastern stock, with accompanying new insect pests and new diseases to be combated by our orchardists.

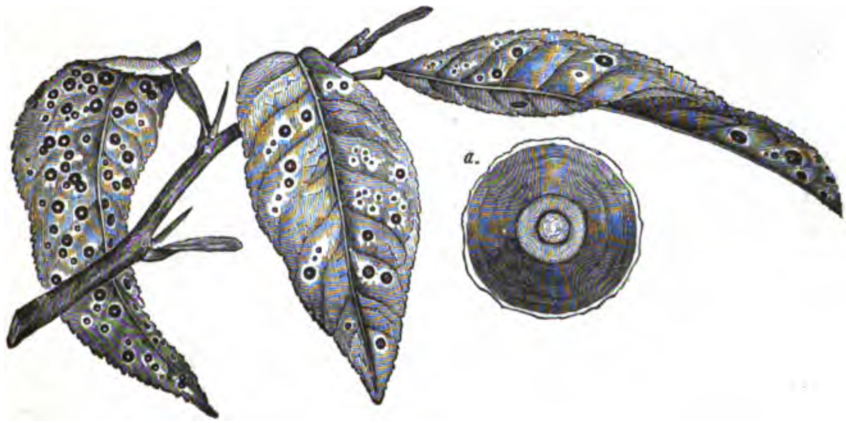
A reference to the English walnut tree census will reveal the fact that a large acreage is already productive, and to this nearly the same number of trees will be added this year.

The large importation of Florida orange stock into the county during the past year, much of which was infested with new insect pests, obliged the Commission to enforce the State law relative to quarantine. It was made effectual in every case, and has certainly proved a protective measure for the fruit growers of the county.

This Commission feels that there is great need of radical change in the present laws relative to horticulture, and that further legislation is necessary to more freely promote the interests of this leading industry of the State.

FLORIDA RED SCALE.

Aspidiotus ficus, Ashmead.

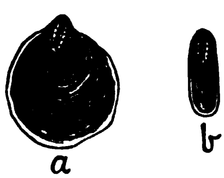


LEAVES INFESTED BY THE SCALES.

[A red scale which infests citrus trees in Florida, settling on the young wood, leaves, and fruit. (*a*) The female scale, enlarged.]

CHAFF SCALE.

Parlatoria pergandii, Comstock.



[(*a*) Scale of female, enlarged. (*b*) Scale of male, enlarged.]

The permanent organization of County Horticultural Commissioners, consisting of the five southern counties of the State, effected in August, will, without doubt, prove of great value to the Commissioners and fruit growers of this county.

Respectfully submitted.

F. EDWARD GRAY,
Secretary.

SEPTEMBER 25, 1890.

REPORT OF THE MENDOCINO COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: Early in the present year the Board of Supervisors of this county, at the earnest solicitation of many fruit growers, raised the pay of the members of the Board of Horticultural Commissioners from $3 to $5 per day.

Mr. Thomas, of the Second District, did good work during the spring, visiting many orchards and inspecting the same, and inducing owners to take measures for disinfection. The long continued rains made it difficult to examine orchards, and effective work at the proper season impossible.

The principal enemies to fruit found by Mr. Thomas were the San José scale, in and around Ukiah, and the codlin moth found nearly everywhere.

Mr. Purdy, in the Third District, found San José scale near Hopland, in two orchards, and had previously found it in some orchards there, about one fourth being infested. That country is not thickly settled, and the spread of the scale seems slow.

In Anderson Valley he found many peach trees dying; apparently healthy trees, loaded with fruit and in fine condition, suddenly withering and dying. The loss was blamed to a small black beetle which bored into both trunk and leaves, leaving gummy spots on the bark. The same, or a closely allied beetle, has been noticed in prune trees near Ukiah. In this instance, however, the trees have not died, and the boring seems confined to dead wood.

Many trees are being planted throughout southern Mendocino County, pears and prunes leading. In the redwoods a great many apple trees are being planted, and the products show the soil and situation to be admirably adapted to the purpose. Much interest in fruit culture and in protection against insects is shown by growers, and the Commission has everywhere had a welcome and found a willingness to do what is needed.

Respectfully submitted.

CARL PURDY,
Secretary.

UKIAH, August 6, 1890.

REPORT OF THE NEVADA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: During the past two years of work performed by this Board we find a gradual decrease of all fruit pests, especially the San José scale, so called. The codlin moth is another enemy to fruit culture, which seems almost impossible to exterminate, the main trouble being that there are many orchards that do not pay the owners to keep clean, as there is no sale for their fruit since the mines have shut down. On this account we have to seek a market outside of our county. This obstacle, we hope, will soon be removed. Where there are better transportation facilities, many new orchards are being planted.

We grow very fine peaches, pears, prunes, grapes, and apples, which always command high prices.

Horticulture is rapidly advancing in every section, and it will only be a short time when we shall stand foremost as a fruit-producing county.

Respectfully submitted.

J. R. VINEYARD,
Secretary.

SEPTEMBER 30, 1890.

REPORT OF THE ORANGE COUNTY BOARD.

To the honorable the State Board of Horticulture:

Orange County is the youngest of the sisterhood, being but little over one year old. It was organized out of the southern part of Los Angeles, and contains a little over seven hundred and fifty square miles.

Its assessed value of property is $9,023,875. Its rate of taxation is $1 65 per $100.

One transcontinental railroad (the Atchison, Topeka, and Santa Fe) passes through it. Another (the Southern Pacific) terminates in it. Its population is thirteen thousand six hundred.

The Pacific Ocean bounds it on the west and the Sierra Madre Mountains on the east.

Two rivers, the Santa Ana and the Santiago, run across it from the mountains to the sea, and furnish water enough to irrigate all lands not irrigable by artesian wells.

The mountains on the east furnish in small quantities, gold, silver, tin, iron, coal, chrome, gypsum, gas, and asphaltum.

Forty miles of coast line furnish two good landings for vessels and steamships—Newport and Anaheim landings.

Its mortgage indebtedness is now $181,032 less than one year ago.

Horticulture is the leading industry of the county. The Assessor's report shows the list of the fruit and nut-bearing trees, as follows:

Quince	2,000	Orange	423,950
Lemon	13,475	Olive	4,500
Apple	96,430	Pear	63,130
Peach	38,480	Fig	7,500
Prune	72,670	Apricot	120,950
Plum	3,640	Nectarine	2,430
Cherry	490	Almond	730
Pecan	120	Walnut	126,640
Chestnut	47		

It will thus be seen that the total number of fruit and nut trees in this county is nine hundred and seventy-seven thousand three hundred and eighty-two, nearly one half of which are orange trees.

The present season is phenomenal for the abundance of all varieties of fruit, and the quality has never been surpassed. It is too early now to give statistics, but we are able to state that some growers have realized as high as $500 per acre for apricots. Peaches and prunes have paid nearly as well. Citrus fruits promise better this year than any former year.

This county has been seriously affected with several varieties of fruit pests. The scales found on citrus trees are: First, red scale (*Aspidiotus aurantii*); second, soft orange scale (*Lecanium hesperidum*); third, black scale (*Lecanium oleæ*). The white cottony cushion scale (*Icerya purchasi*) has not as yet made a lodgment in this county. Nor have any of the Florida scales.

This Board proposes to discourage in every legitimate way the introduction of Florida stock into this county.

The only scale that has seriously affected the citrus industry in this county is the red scale. It has taken us a long time to learn how to treat it, but we think we have two good remedies now—the resin wash and the gas treatment.

Deciduous fruits are badly affected by San José scale (*Aspidiotus perniciosus*), the codlin moth (*Carpocapsa pomonella*), and the woolly aphis (*Schizoneura lanigera*). But little has yet been done for their destruction.

This Board has used all the power given it to quarantine against the introduction of new pests, and has been rewarded with success. During the coming winter we intend to enter a vigorous campaign against deciduous fruit pests. We regard the law as it now stands as too tedious for successful fruit growing.

Scale insects are too swift at destruction for the slow and uncertain forms of law. Police powers given direct to Commissioners is the only way out of the difficulty.

Respectfully submitted.

HIRAM HAMILTON,
President.
S. W. PEEBLE.
F. H. KEITH,
Secretary.

SEPTEMBER 28, 1890.

REPORT OF THE SAN BERNARDINO COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: Our work the past year has been continued on the lines indicated in our last report. In the field the work of inspection has been vigilantly performed by our staff of twenty-two local Inspectors in the various districts assigned to them. The black scale (*Lecanium oleæ*), the brown scale (*Lecanium hesperidum*), and the San José scale (*Aspidiotus perniciosus*) continue to be the source of our chief trouble. On the Lecaniums we have used the resin compounds most successfully, while on the *Aspidiotus perniciosus* the sulphur, lime, and salt remedy is the only one that has given satisfaction, and the coming season it is

our purpose to recommend its use solely, and have very little doubt of being able to eradicate the pest. The fruit growers of this county are fully alive to the necessity of keeping their premises free from insect pests, and when a remedy is once proved to accomplish the beneficial results intended, "eradication" is their watchword. We do not have to contend, in the same degree, with the baneful and pernicious effects of abandoned or unoccupied properties that the Commissioners in some other counties do, but we do feel, in common with them, the need of a law providing a more summary means of dealing with transgressors. In addition to the insects reported in our last report, we have found the brown apricot scale and an unnamed Lecanium, on box elder, which bears a close resemblance to the brown apricot scale. We have also found one case of *Lecanium hesperidum*, on pepper trees. The codlin moth has made rapid strides the past year, owing, we think, to the importation of eastern apples. It has been particularly noticeable on pears. On the other hand, the common species of ladybugs and the lace-winged fly have been very numerous. We very much regret being unable to furnish accurate statistics of the past season's planting; in the aggregate it has largely exceeded any previous year.

Respectfully submitted.

W. E. COLLINS,
Secretary.

SEPTEMBER 29, 1890.

REPORT OF THE SAN JOAQUIN COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: San Joaquin County is estimated to contain about nine hundred thousand acres of tillable land. Almost every acre of this immense area is suitable for fruit growing in all its varieties. The simple inspection and location of infested orchards in this vast territory is a work of magnitude involving the expenditure of much time and travel in its accomplishment. Only the northern portion of the county, bordering on the Mokelumne River, has received much attention up to this time, but other sections will be visited later in the season, and it is hoped with better results.

The Woodbury and resin washes have been recommended for summer use, while the trees are in full foliage. For fall and winter use the lime, sulphur, and salt preparation (Covell's formula) has given general satisfaction, and is recommended in preference to any other. We have also recommended the Bean automatic spray pump as the best of any seen or used for that purpose.

The young orchards, planted within the past two or three years, were almost universally found in a healthy, thriving condition, free from scale and other insect pests, the trees pruned to low heads, and the land clean and well cultivated, showing care, skill, and good judgment in their treatment, and in marked contrast to the condition of the old orchards, which showed the entire absence of all those important elements of successful culture. The latter were unpruned, the trunks and limbs covered with rough, moss-grown bark, in most instances composed of masses of dead or dying wood, and their unsightly branches almost hidden from sight by loathsome myriads of San José scale, red spiders,

and woolly aphis; the foliage distorted by curled leaf, green aphis, and shot-hole fungus; and the fruit showing the presence or ravages of scale, codlin moth, and the above named fungus. These old orchards are a perpetual menace to the prosperity of this great and growing industry, and they should be severely pruned and disinfected, or, better still, destroyed, root and branch, without a moment's hesitation, before they can infect the young orchards in their neighborhood.

In a tour of inspection made through the northwestern part of the city, hardly a place visited, and containing fruit trees, but was found more or less infected. Among the most prevalent were found San José scale (*Aspidiotus perniciosus*), cottony cushion scale (*Icerya purchasi*), black scale (*Lecanium oleæ*), yellow orange scale (*Aspidiotus citrinus*), codlin moth (*Carpocapsa pomonella*), and woolly aphis (*Schizoneura lanigera*). The most dreaded of these, because the most difficult to exterminate, aside from its marvelous fecundity, is the cottony cushion scale, but is very easily destroyed by the *Vedalia cardinalis*.

The pests enumerated above are surely enough to alarm the well-wishers of the horticultural interests of San Joaquin County, and rouse them to action before they are utterly destroyed by neglect.

Reports were received by the Board regarding experiments made in pruning apricots in August and February of each year—same variety, on same soil, standing alongside each other and receiving the same care and cultivation. The results were that those pruned in August blossomed ten days earlier and the fruit ripened two weeks sooner. The late sap that formed wood in February formed more fruit spurs in the August pruning. The crop was larger and the heads of the trees made a more uniform and compact growth.

Some complaint has been made—though not more than was to be expected—because the San Joaquin Commissioners were apparently alone in their efforts to secure a compliance with the law by excluding infected fruit from the local market, while the same found ready sale in San Francisco, and the dealers there defied and disregarded it. The bugs have come to stay, and we shall always have to fight them in future. That will hereafter be one of the conditions of successful fruit culture.

Among other things noted may be mentioned the fact that the persons in charge of the fruit exhibits at the State and District Fairs placed on the tables fruit pitted and spotted with marks, showing the presence of scale and other insect pests. This in itself ought to have barred their entrance, and certainly should deprive them of any chance of competing for premiums in the opinion of competent judges in such matters.

During the early part of the past month the work of the Commission was confined to the inspection of infested places in the city and its immediate vicinity, the determination of species brought to the office, and the distribution of the reports and bulletins of the State Board, of which it has received a liberal supply.

It gives us great pleasure to be enabled to report the successful introduction of the deadly insect foe of the fluted scale (*Icerya purchasi*). Commissioner Robinson went to San Francisco on the twelfth and spent several days in endeavoring to procure the new species of *Coccophagus*, the neuroptic parasite of the yellow orange scale (*Aspidiotus citrinus*) and the *Vedalia cardinalis*, the parasite of the cottony cushion scale, from Secretary Lelong.

The cottony cushion scale had already secured a strong foothold in

the gardens of this city, under circumstances fraught with damage and disaster to both fruit and flower. Among economic entomologists this is the most intensely dreaded of all insect pests, not only on account of its filthy habits, disgusting appearance, rapid increase, and deadly effects, but its omnivorous characteristics, no fruit or ornamental tree, shrub, plant, or flower claiming immunity from its ravages. No remedy had been found adequate to the task of its extinction, and the ultimate destruction of every species of plant life subject to its attacks seemed assured before the advent of this important auxiliary. The Vedalia was colonized at two places where the scale was very abundant, and destroyed the scale in a very short time; the city is now entirely free from this pest.

The portion of the county east of the Southern Pacific Railroad and north of the Calaveras River was set apart as a district to be known as the Lockeford Fruit District, and George W. Wise assigned as local Inspector thereof.

Inspector Wise reported that during October he visited many orchards in his district, and gave the owners what information he had, so preparations could be made in due time for exterminating the pests, which were found everywhere.

Insect pests are preserved and propagated by old neglected orchards in various parts of the county, that have thus become breeding places of all manner of injurious insects, infesting new orchards in their immediate vicinity and spreading thence over the whole State, through the various channels of transportation by land and water, threatening the annihilation of the whole fruit industry. To counteract this alarming condition of affairs needs the most strenuous efforts and hearty coöperation of the friends of horticulture everywhere, and a rigid enforcement of the provisions of the amended law by the officers whose duty it is to adopt stringent measures for the extirpation of those insect pests. With a thorough inspection of the orchards throughout the county, and a vigorous and regular supervision of the fruit stands in the city, this can be done, and the objects for which the law was framed accomplished.

The success attained by the system of the daily inspection of fruit stands, wagons, and boats encouraged the County Board of Horticulture, also believing it to be the best and most effective method of securing the result aimed at—the exclusion of infested fruit from the city markets. The Inspector assigned to that duty reported fruit cleaner and freer from insect pests and diseases than ever known during the past ten years, for the whole of which period he has been officially connected with the Commission, thus amply justifying the wisdom of the course pursued.

The demand for California fruit for shipment East, and the very high prices paid this season, will certainly lead to the planting of numerous young orchards in every county of the State, where fruit raising can be made remunerative. The unprecedented continuous rain storms of last winter interfered with all kinds of nursery stock, and left the land in such an unfit condition that nursery stock will be very scarce and high priced, and immense numbers of young trees will be imported from nurseries east of the Rocky Mountains.

It is the duty of this and other Boards of Horticulture to raise a note of warning and establish a strict quarantine against localities known

to be infested, and carefully guard their respective neighborhoods from the introduction of new fruit pests and diseases. Besides the insects infesting the orange groves of Florida, about which Secretary Lelong has warned us, we cannot too diligently watch for the destructive curculio infesting the plum and the mysterious yellows of the peach—both yet unknown in this State—the latter being a dread disease, whose origin is unknown, and for which no remedy has yet been found.

Respectfully submitted.

W. H. ROBINSON,
Secretary.

SEPTEMBER 30, 1890.

REPORT OF THE SANTA BARBARA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: Herewith we beg to submit the annual report of the Santa Barbara County Board of Horticultural Commissioners:

The work of this Commission has been pushed with considerable vigor by each member of the Commission, the whole work up to date having been done without the aid of any deputies.

That portion of the county lying north of the district consisting of the Santa Ynez, Santa Monica, and Lompoc Valleys, with their tributary valleys, has been thoroughly inspected, discovering a vast amount of infected trees as a consequence of no previous attempt to look for injurious insects.

We found something over two hundred thousand deciduous and olive trees, with here and there an occasional small planting of citrus trees. The deciduous trees in a large percentage of the orchards are found to be affected with San José and greedy scales, red spider, and a limited quantity of black and brown scales. Woolly aphis was also found in two or three instances where there can be no question of the economy of uprooting trees. One instance is reported by a private party, who, finding woolly aphis in his small orchard, after trying American concentrated lye in various ways, concluded that a solution strong enough to kill the insects would kill the trees; he therefore, without further ceremony, uprooted the last tree, and made up his mind to plant anew in other ground.

Powdery mildew was found to be making considerable headway in small orchards, as also the pear blight. Rose rust was found on many of the choicest roses.

The Norfolk Island pine scale has been found in one instance, and it is a rare thing to find a clean Texas umbrella tree. The black scale is in a general way confined to the olive, although in the lower end of the county a large amount of the same is found on the apricot, peach, and pepper trees.

A new insect of the geometer type made its appearance at the ranch of Hon. Ellwood Cooper on many of his walnut trees. He controlled them principally by the use of Paris green.

The cottony cushion scale is very nearly exterminated by our blessed little friend, the *Vedalia cardinalis*.

Very much good has resulted from the application of the wash prescribed by Professor Coquillett. Fruit half grown, after spraying with this solution, developed smooth and clean. The apples and pears are particularly fine after this treatment.

Considerable apathy is manifested by small orchardists where trees will soon be completely overrun by the red spider, and there is no question in the minds of our Commissioners that what we really need, and must have, to do effective work in this direction, is the passage by our Board of Supervisors of an ordinance similar to Ordinance No. 26, passed by the Board of Supervisors of San Bernardino County, to whom be it said all praise is due for the diligence with which they are coöperating with the Horticultural Commissioners of said county. A great deal of our work was, in consequence of such continuous and heavy winter rains, necessarily crowded into the early summer months, but everything demonstrates the increasing necessity for active, vigorous work from one end of the county to the other, until this county (in conjunction with others) is rid of these vicious insect pests.

The common ladybug has been observed feeding upon the woolly aphis, but it is worse than useless to rely upon such a means of ridding ourselves of this, one of our worst enemies.

The codlin moth is found in considerable quantities in the lower portion of the county.

Respectfully submitted.

ROWLAND MACHIN,
Secretary.

September 25, 1890.

REPORT OF THE SONOMA COUNTY BOARD.

To the honorable the State Board of Horticulture:

Gentlemen: This Commission was organized November 4, 1889, consisting of J. H. Bailhache, M. L. McDonald, and E. A. Rogers. The Supervisors set our compensation at $1 per day. We have been unable to find any one to serve as local Inspectors on account of such meager allowance.

We find the San José scale in the majority of the orchards that we have inspected in the county. In some localities we found they had sprayed last winter with the salt, sulphur, and lime remedy with good results. In some cases, where the scale was left to increase, the orchards were nearly destroyed by their attacks. In some orchards the codlin moth has been found, and is very destructive, and little is done to destroy them; some orchardists are using the band system.

The woolly aphis appears very numerous in old orchards away from the coast; in those near the coast I found but very few. Very little or no attention is paid to this pest.

We have found the cottony cushion scale in one orchard, and also on shrubs in flower gardens. We have placed a colony of *Vedalia cardinalis* wherever infested.

We have sprayed Winter Nelis and Easter Beurre pears and Winter Pearmain apples with the Bordeaux mixture for fungoids, with good results. The spraying was done April twenty-fourth.

We recommend the salt, sulphur, and lime remedy for the San José scale. It was used very extensively last winter in some parts of the county, and where thoroughly used good results were obtained.

Respectfully submitted.

E. A. ROGERS,
Secretary.

September 25, 1890.

REPORT OF THE SUTTER COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: We beg leave to submit this the first annual report of the Sutter County Horticultural Commission:

The Board of Supervisors of Sutter County appointed R. C. Kells, J. C. Gray, and H. P. Stabler a Board of County Horticultural Commissioners, on September 4, 1889, and fixed the compensation at $3 per day for the time actually engaged in the service. The compensation of the local Inspectors was not fixed at this time, as the law requires, but the Commission was given to understand that the Inspectors would receive the same per diem.

The Commission organized on September 16, 1889, by the election of R. C. Kells as President, and H. P. Stabler as Secretary, and decided to hold regular meetings on the third Saturday of each month.

A circular was at once prepared and sent to all fruit growers in the county, advising them of the appointment of the Commission, urging them to observe the law in regard to pests, and requesting correspondence on all matters pertaining to the suppression of pests. Another circular was addressed to nurserymen throughout the State, warning them to send no infected trees to Sutter County the coming season. The Secretary was instructed to purchase the necessary books and stationery. When the bills for the minute book of the Commission, the stationery, and the printed matter were presented to the Board of Supervisors, that body absolutely refused to pay them, and the bills remain unpaid to the present day.

In due time the Commission divided the county into seven fruit districts, appointing an Inspector for each district. The first work done by the Inspectors was the work of examining the local nurseries, assigned to J. B. Wilkie, of the Yuba fruit district. In his report he informed the Commission that there were thirteen nurseries in the district; and all of them were infested with the San José scale. The time consumed in making the examination was seven days, and the Supervisors appreciated the importance of the work by allowing the Inspector *one dollar a day* for his services, thus establishing a rate of compensation for the local Inspectors throughout the county. The local Inspectors throughout the county at once tendered their resignations, and the Commission has been in a very awkward position during the year. Under the circumstances, the Commission decided to make as many inspections as possible and publish in the local papers the most approved remedies and their manner of application. Accordingly, the "lime, salt, and sulphur wash," the "resin wash," the "Paris green mixture," and the "whale-oil soap and sulphide of soda" remedies were published at the proper season in the local papers, and by using the same type, the above remedies were printed in circular form and five hundred copies of each remedy sent, without expense to the county, to every fruit grower in Sutter County.

The correspondence in regard to these subjects has become quite large and has been promptly attended to.

We feel very much the need of active local Inspectors, and have several times gone before the Supervisors and asked that the compensation of the Inspectors be increased to a reasonable sum, but in every case they have refused to do anything in the matter.

At the present time many orchards in Sutter County are infested with San José scale, red spider, codlin moth, and pear slug. The importance of horticultural interests demands that something be done to stop the spread of these depredating pests. The fruit growers of the county recognize the need of thorough and systematic spraying of their orchards, and have always been ready to use the remedies recommended by the Commission.

Respectfully submitted.

H. P. STABLER,
Secretary.

SEPTEMBER 25, 1890.

REPORT OF THE TULARE COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: We have the pleasure of submitting to you our annual report for Tulare County.

This has been a prosperous year with our people, and there is so much to report connected with our work we find it difficult to be brief enough.

The valley of Tulare is distinct from the San Joaquin Valley. All the waters of this valley run into Tulare Lake, and has no outlet to the sea, while the waters of the San Joaquin Valley run into the bay of San Francisco.

The soil is different from anything in the State. Artesian boring shows the soil to be alluvial for at least twelve hundred feet, apparently as fertile on the bottom as the surface.

Tulare Valley embraces about half of Fresno, and all of Tulare and Kern Counties, and is as large as the States of Rhode Island, Connecticut, and Massachusetts.

Tulare County is the center of this valley, and is watered by Kings, Kaweah, Tule, White, and Kern Rivers. These rivers rise in the high Sierras, whose tops are covered with snow all summer, and furnish a never failing supply of water for irrigation, and run west and south to Tulare Lake, traversing the county from east to west, so that the whole area may be irrigated. Running from these rivers are deep sloughs traversing the whole country as they meander toward the lake, making all these rivers like the Mississippi, which empties its waters into the Gulf by many mouths. These sloughs are deep and drain the country when irrigated, so that our lands will never become impregnated with alkali as the lands of India, and even portions of our own State. A large portion of the land of Tulare County is irrigated by percolation.

This can be done nowhere else so perfectly in this State as here. This reduces the expense of irrigation almost to nothing; a ditch full of water will wet the land for half a mile. This is considered a dry country, five and one half to six inches being our average rainfall, and until within the last ten or twelve years the waters of our rivers were not used to irrigate.

Herds of cattle and horses roamed over the plains of Tulare County, and the rearing of these was the only industry known to the people.

First, what farming there was, met with such poor success that the land became known as the "Land of the Devil." This is all changed now. The county this year has exported over two million sacks of wheat, being the banner wheat county in the State. But fruit culture

is taking the lead, and the wheat fields, with their steam harvesters, are rapidly disappearing, and the orchard and vineyard is dotting the plains.

It is almost impossible to give even an approximation of fruit shipped from this county. From Hanford there were shipped this season eight hundred thousand pounds of dried fruit, and three hundred thousand of green. Tulare shipped two hundred thousand pounds of dried, and one hundred and fifty thousand pounds of green fruit. Visalia, two hundred and eighty thousand pounds of dried, and two hundred thousand pounds of green fruit.

In this county all deciduous fruits do well, and along the foothills oranges and lemons grow as well as anywhere in the State. The olive will grow anywhere in the valley, and the English walnut does moderately well in the foothills.

Last season five thousand five hundred acres were planted to raisin grapes in the Lucerne District of Tulare County, and perhaps as many acres in the other portions of the county. This next season many more acres will be planted to vines. More vines are rooted this season than at any time, and many of them are sold already, to be planted next spring.

The French prune on peach stock does exceptionally well all over Tulare County. One tree, six years old, at Visalia, yielded this year *one thousand one hundred and two pounds.* One at Grangeville, seven years old, yielded *one thousand one hundred and forty pounds* this season. Prune orchards will yield in Tulare County from five hundred to seven hundred pounds per tree when six years old, grafted on peach stock, and this season have produced $1,000 per acre.

Peaches do better here than in any other part of the State, yielding this season from $400 to $600 per acre, some weighing as high as twenty and one half ounces.

Insect pests, for some cause not clearly defined, have disappeared almost entirely in the western part of the county. The lime, sulphur, and salt compound has been used unsparingly against the San José scale, and orchards not sprayed are as clean as those that were. The season and parasites likely have done most of the good work.

All along Tule River, and around Porterville, the San José scale is still doing its deadly work. All the apples and pears are spotted with scale. But little has been done to destroy the insect. The woolly aphis and codlin moth are both very troublesome in this district.

Around Visalia, insect pests are kept in check, and the fruit is clean. The same may be said of Tulare.

It is difficult to predict the future of this county. Unless some calamity befalls our fruit and raisin industry, within the next five years this will be the center of the fruit and raisin industry of the State.

Respectfully submitted.

N. W. MOTHERALL,
I. H. THOMAS,
I. N. WRIGHT,
Commissioners.

REPORT OF THE YUBA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: During the latter part of the month of September, 1889, the appearance of the orange trees in the Marysville yards was truly revolting; the leaves were yellow and withered, and seemed to be in the last stages of dissolution. Some of the trees had died. The trouble continued to grow until the attention of some of the prominent citizens was called to the matter. A meeting was held, and the result of which was the presentation of a petition to the Board of Supervisors, asking for the appointment of a Board of Horticultural Commissioners to look after the fruit industry of Yuba County. A Commission was appointed at the October, 1889, session of the Board of Supervisors, as follows: G. W. Harney, President; J. W. Mills, Vice-President; F. W. Johnson, Secretary.

A year has gone by since the appointment of the Commission, and if proofs of its value to the county of Yuba are needed, they can be found in the condition of the Yuba County orange orchards. Infested by, and nearly dead from, the ravages of the yellow scale, those orchards were taken in hand and treated in such a thorough manner that to-day they stand in their glossy, beautiful green coats, monuments to the wise laws that provide for Horticultural Commissions.

Our annual report to the State Board of Horticulture can best be prepared by writing a synopsis of all our reports to the Board of Supervisors of Yuba County. In January, 1890, the following report was made:

"During the month of November, 1889, notice was served on about one hundred owners of infested citrus trees, which resulted in the spraying and cleaning of about twelve hundred large trees—nearly all the infested trees in the city of Marysville. The wash used was a resinous compound manufactured under the supervision of Commissioner G. W. Harney. By means of this wash we believe that 95 per cent of the scale was destroyed. The work of spraying was discontinued on account of the heavy storms, but will in all probability be resumed in the spring. A number of inspections were made of country orchards.

"During the month of December the Board held meetings to determine the best means to be adopted to prevent nurserymen from bringing in infested trees or nursery stock. Placards were posted cautioning the public against the danger of insect pests, and every care will be taken to prevent the importation of any more pests.

"There are very few places where fruit trees are grown in this county that do not show some traces of insect pests. As the fruit industry of Yuba County is yet in its infancy, it is quite essential that this evil be checked now, and that the people be educated as to the proper means to be used. The Commissioners are about to prepare printed slips and posters giving the proper remedies for the different pests; these will be sent throughout the county and distributed gratuitously to those interested."

In April, 1890, a report was prepared as follows:

"During these months a series of inspections were made and notifications served in all the infested districts. Meetings of the Commissioners were held, at which the following remedies were adopted: Remedies for

pernicious scale, winter and summer; remedy for pears and apples infested with perniciosus; remedy for early ripening apples and pears infested with codlin moth; remedy for woolly aphis; remedy for flowering shrubs and plants infested with woolly aphis; remedy for yellow scale on citrus trees; remedy for aphis on rose bushes; remedy for black smut on roses; remedy for borers.

"*Regarding Beneficial Insects.*—Whenever beneficial insects or parasites are decreasing the spread of scale and other pests, no spray or wash should be used."

Orchardists are requested to pay particular attention to the colonization of these beneficial insects. We find that it is not always necessary to import them; that Nature oftentimes places them just where they are needed without the intervention of man. An inspection made a short time ago by one of our Commissioners will illustrate this point:

A seedling orange tree, imported some two years ago, after being planted six months, developed a large number of black scales. These insects lived and thrived on the trees, and after a short time began to exude quantities of black smut over the limbs and leaves. No effort was made by the owner to rid the tree of the pest, but an inspection this spring shows that not a scale is left, and that the tree is in the possession of a colony of ashy-gray ladybirds, who have eaten up every vestige of the black scales. In this case Nature has stepped in and prevented the spread of a pest that might have caused great loss.

The citrus trees in and about the Marysville yards were sprayed with a resin wash. We have no hesitancy in pronouncing these trees to be in a better condition now than at any time during the past six or seven years. Very few of the yellow scales are now active, some 95 per cent of them having been destroyed.

A row of elm trees on D Street was discovered to be infested with filbert scale. During the month of March they were sprayed with a caustic wash under the supervision of the Commissioners, which resulted in the partial destruction of the pest.

At a meeting of the Commissioners, Messrs. Harney and Johnson were appointed to represent Yuba County in the convention of Horticultural Commissioners at Los Angeles, March 11 to 16, 1890.

A series of inspections of the fruit kept for sale in the Marysville fruit stores have been made. Circulars and letters have been sent to the fruit men, asking them to refrain from purchasing infested fruit.

On July twenty-third we found on all the fruit stands a small quantity of infested pears. Prompt notice was served on the seller, who promised to destroy the fruit and not to offer any more for sale. Therefore, no suit was commenced against him.

Careful inspection of the Marysville orange trees have been made; few traces of live yellow scale were found.

Inspections in the latter part of July show, however, that under the influence of the warm weather the scale is becoming active. Some Marysville citizens have kindly reported to us their observations, which bear out our conclusions.

Inspection of the Colmena orange grove was made, and no trace of scale was discovered there.

Inspections of the fruit being handled by the Marysville cannery were made; it was all found to be in good condition.

The cannery managers report that fruit properly protected from the

ravages of scale pests is bound to bring a better price than neglected fruit. Incidentally the following information concerning the work of the Marysville cannery was obtained:

During the season they give employment to about two hundred people. They expect to put up this year about one hundred and thirty tons of apricots, one hundred tons of cherries, four hundred and fifty tons of peaches, two hundred tons of Bartlett pears, and one hundred tons of plums, etc. In all probably one thousand tons of first grade canned fruit will be shipped from here branded "Marysville Fruit."

During the spraying season our Board had printed, at their own expense, a series of remedy slips for distribution among the fruit growers. These slips were diligently circulated, and have, no doubt, been productive of much good.

Inspections of the orchards in the southeastern portion of the county have been made from time to time, and where the scale has been found to exist the attention of the owner was called to the trouble, and remedies prescribed for the eradication of the pests.

GEORGE W. HARNEY,
President.

MARYSVILLE, August 14, 1890.

APPENDIX B.

CHERRY CULTURE—ROSE CULTURE—PREPARATION OF THE CALIFORNIA PRUNE.

CHERRY CULTURE.

To grow cherries successfully it is necessary to comply with certain conditions. Those which I consider the most important I will notice:

FIRST—SELECTION OF SUITABLE TREES.

Cherry trees are now generally propagated on Mazzard seedlings, grown in France. They drill the seeds in rows, and at the end of the first season's growth take them up and assort them into three or four sizes, viz.: Extras, No. 1, No. 2, and No. 3. They vary all the way in size from that of a small straw to one half inch at collar. They use the extras at home and export the other grades. If we take the No. 1 grade (about one fourth inch in diameter at the collar) and plant in a good, loamy soil, in the coast and bay counties, grow without forcing by irrigation, and bud the first summer or graft the first winter, at the end of the second year we have what we call a one-year old tree; and we should have at least two thirds of a planting running from three to five feet in height. We call such a production first class trees, and not being stimulated by irrigation, they form the terminal bud in the latter part of the summer and early fall, and have the balance of the growing season to ripen and harden the wood. This class of trees I consider suitable to start with in planting a cherry orchard. On the other hand, if we take the third class stock mentioned above, plant it in the interior of the State, where the spring growth commences early and the summers are clear and warm, irrigate it thoroughly—by September we will have the stock large enough to bud; in all probability larger than the first class stock grown without irrigation, and if we follow with a plentiful supply of water the second season, we can produce trees, two thirds of them or over, ranging from four to six feet in height, straight stalks, and smooth bark, and to the inexperienced eye better looking trees than the No. 1 described above. But this class of trees would be an unsuitable one to select in planting a cherry orchard. The foundation (the stock) is inferior to commence with, the wood will be coarse and unripe, the trees will not bear the transplanting as well as those we have designated as suitable. They will go back on the planter in their future growth compared with the suitable trees.

The above remarks will apply to all of our stone fruits, especially the apricot and peach. Peach trees and apricots grown on peach stock are propagated by planting the seeds in the nursery (where they are to stand until the trees are ready for sale), and budding the first season those which grow large enough. The smaller ones are pulled out and thrown away (or should be); but suppose we take the small ones, about the size of a straw, transplant, and force them up to a budding size the second season, force them the third, and we may grow a fine looking tree in this way, but it would be one that I could not be induced to plant under any consideration. Yet this is precisely what has been done to a large extent in this State with the apricot on Myrobolan plum

stock. In discussing the growing of the cherry, as well as other fruits, I cannot lay too much stress on the quality of the stock used. I have no objection to irrigated trees from the simple fact of irrigation, for no trees will grow without moisture in the soil; but too much water is generally used, and too late in the season to produce well ripened wood, suitable for transplanting. If the nurserymen who irrigate will use none but first class stocks and less water, so as not to produce overgrown trees, they will confer a lasting benefit on their customers. Now, to the fruit grower let me say: Buy your trees direct from the grower and demand a guarantee that they are grown on first class stocks; for there is more difference in the growing of a successful and lasting orchard, between trees started on first class stocks and those on third, than the average fruit grower is aware of.

SECOND—SOIL AND SITUATION.

The cherry does best in a sandy loam, but it should be of good depth and well drained. In my district but a small portion of our lands is suitable for cherry growing. The character of the soil is all right—a sandy loam, good potato soil—but the depth and drainage are not sufficient. I have been growing the cherry for thirty years with varying results. A portion of my first planting proved a success, while the other portions were a failure, and in places the trees are all gone. There is something about our land that I do not fully understand. It seems to be spotted. We may plant, say five acres in a body, to cherry trees, apparently all the same quality of land. In the course of two or three years they will commence to die out, and at the end of twelve or fifteen years perhaps two thirds of them will be gone, and the balance will be standing in groups here and there over the five acres. To the superficial observer there would appear to be no difference—no reason why the trees should not do as well on one part of the tract as on another. In digging ditches, I find a difference in the depth and appearance of the soil below. Those spots where the trees die out the most are generally the shallowest, and below of a more grayish cast. I do not believe that it is the shallow soil alone that kills the trees, because I have one spot of near one half acre at the top of a ridge, sloping to the north (the most favorable position for the cherry), where none of the stone fruits will last for any length of time. I have planted the plum, apricot, peach, and cherry. The soil is as deep as any in the orchard. I do not know for a certainty, but I suspect that alkali has something to do with causing our spotted orchards. In selecting suitable land in my district for planting the cherry, I would select land sloping north to northeast, and on the highest land to be found. I would dig prospect holes in various parts of the tract, and if it proved to be of a less average depth than three feet I would reject it as unsuitable for the cherry. The Cassidy orchard is located at the top of the high land on the northwest of Petaluma, sloping to the north and east, and the best paying portion of my cherry orchard is located near the top of my highest land, with quite a steep descent to the north; the highest part one hundred and fifty feet above the lower parts of the place.

THIRD—THE CARE OF CHERRY TREES.

After planting is as simple as that of any other deciduous fruit trees. They should be headed low, trained in the vase form, and pruned regularly the same as other fruit trees, but do the pruning early; the month of November is the best time to do the work on trees in orchards not irrigated. I have made a success in the past three years in reheading some old cherry trees. I did the grafting in the month of November, commencing about the first of the month, and cutting away half of the top the first season, and the remaining half the second season. This fact satisfies me that the pruning should be done early in the season. The cherry is well adapted to the cool, moist climate of our coast counties, but the need of thorough drainage is the greatest drawback to cherry growing in the coast counties. The cherry can also be grown successfully in the interior of the State under favorable conditions. Marysville is one among the hottest places in the State. The old G. G. Briggs cherry orchard, on the Yuba River above that place, was one of the most successful cherry orchards ever planted in the State, until the river filled with debris from the mines and overflowed it. But what were the conditions? The most favorable that we can imagine—a rich, alluvial soil, twenty to thirty feet to low-water mark, no hardpan or other strata to prevent the free passage of water up or down, and when the trees are dormant the water in the river would generally be below the level of the roots. The river would rise from the melting snows in the mountains, and bring the water to a higher level in midsummer, supplying the trees all the moisture needed, and then recede in August, which would give the ground a chance to dry somewhat, and allow the trees to ripen and harden the new growth.*

* W. H. Pepper, in an essay read before the State Horticultural Society, 1890.

FLORICULTURE.

ROSE CULTURE.

Perhaps there is no country in the wide world where the rose can be grown to greater perfection than in California; yet many here grow the queen of flowers with but indifferent success. This is partly owing to lack of knowledge, partly to lack of proper attention, and sometimes to unfavorable soil or climatic conditions; for even here some localities are too hot and dry, and some too cold and damp to hope for the best results in rose growing. But these two latter difficulties can be largely overcome by intelligent culture and a proper selection of varieties. Right here we desire to raise a voice of caution against reliance on the eastern books and catalogues as guides to rose culture on the Pacific Slope, for experience has demonstrated that many rules and directions therein given do not apply here, and many sorts that succeed well on the other side of the Rockies do but poorly with us, and vice versa. Perhaps this statement needs a little qualification, however, for possibly no sort will grow more poorly in most sections of this State than at the East; but as a rule the many sorts do so much better with us that by comparison the one is a failure and the other a success. So it comes to pass that we must be governed by our own experience. Again, many sorts succeed weil only under glass, while others succeed well only when grown in the open air. We like best those that do well in either situation.

PRIMARY REQUIREMENTS.

Canon Hole has said, beautifully and truly, that "he who would have beautiful roses in his garden, must have beautiful roses in his heart."

No plant responds more generously to good and loving care than the rose. True, in rare cases it will grow with great luxuriance and beauty in spite of neglect, but kind and intelligent treatment seldom fails to bring its sure reward.

It is the purpose of this essay to give some hints that may assist the devotee at the shrine of the lovliest of all the floral kingdom, so that he may see our queen in the glory of her most regal splendor; but remember that the best gifts rarely come to us of their own accord. They must be hoped for, sought for, and worked for, and that, too, not by blind faith, but by intelligence, reason, and experimental effort. Read and learn from others all you can, reason all you can, do accordingly, and then watch the result, profiting by any hint which experience may give. The outcome cannot well be otherwise than gratifying and satisfactory.

It is the masses that need instruction, therefore this essay will be devoted to the matter of growing roses in the open air, leaving that of greenhouse culture to the gardeners of the wealthy and the professional florists, who are already posted.

LOCATION.

Let your rosary slope to the east or north; let it be securely sheltered from the rude winds, and let broad shadows be cast athwart it at mid-day to protect the beautiful children of your care from the scorching rays of the summer sun. All this is easy enough to say, but in practice not so easy to have and do. Most people must plant where they must, and that is usually in a limited area near the dwelling. Let them plant there whether the ground slope this way or that way, or not at all. Let them protect as best they can, and get shadow from house or fence, or vine-covered trellis, or hedge (a rose hedge, if possible). But it is useless to put your roses close to an ever-hungry eucalyptus, Monterey cypress, or the like, that will consume the milk and honey and oil, and bread and butter, and pork and beans of the soil, leaving the poor plants to perish of thirst and starvation. Better no shadow at all than the shadow of death. The broad sunshine is not to be despised, and if your plants be given a little extra manure—solid and fluid—and a little extra cultivation, the lack of the other advantages will be largely compensated for.

SOIL AND PREPARATION.

The rose loves best a pretty stiff, loamy soil, with a gravelly or sandy subsoil. Stiff adobe is better than a sandy soil, but a mixture of the two is to be preferred. If these conditions do not exist naturally, they can generally be approximated artificially at a moderate expense. Sometimes underdraining has to be resorted to, which is somewhat costly, but this rarely happens. Generally deep preparation of the ground is all that is required, but this must in nowise be neglected. Do it with the plow if you can, for that is by all means the best instrument ever devised for thoroughly breaking up and pulverizing the ground. But it must run deep—clear down to the beam—and if this cannot be done by plowing once, plow till it is done. If the plow cannot be used, then the spade or digging-fork must be made to answer in its place; and the work can be well done by the usual process of trenching, which is so well known as to need no description here.

The proper time to do this work is in the autumn, or beginning of winter, immediately after the first rains have thoroughly soaked the soil. A good guide is the farmer. See when he begins to plow, and if the soil breaks up loose and friable, then is the time to prepare your rose garden, and do it at once.

MANURING.

First of all manure your land, and do it generously. The rose is a gross feeder, and few soils are naturally rich enough for its voracious appetite. If you are to plow and can do it with one operation, first spread the manure thickly—not less than three or four inches deep if the manure be short or well rotted, and still deeper if it be coarse—so deep that it will require to be raked into the furrow behind the plow. Manure from the horse stable containing little straw is usually the best, for when put into the ground it affords a certain degree of bottom heat that is very beneficial to the plants. If you must dig, coarse manure of any kind will not answer. It must be fine. If free from straw, horse

manure is to be preferred for the reason before stated, but that from the cow stable or corral will answer a good purpose. Many prefer well rotted manure in any case. It is stronger, and so undoubtedly best for very poor soil, but such soil is not promising of the best results under any kind of treatment. Again, if planting for any reason be deferred till late in the season, fresh manure should in no case be used, its heating qualities being then a detriment. Nor will it have sufficient time to thoroughly rot before the dry season comes on, and then it will go hard with the plants unless they are well and systematically irrigated. Finish the preparation of the ground with a fine toothed harrow or garden rake, and you are ready for

PLANTING.

This must not be done when the ground is so wet as to be sticky, for it will pack into a mass so solid that the air cannot penetrate nor moisture properly distribute itself to meet the necessities of the growing plant. If the soil be very dry, it is generally better to wait for rain; but if planting be done as hereafter directed, there need be no fear as to a successful result. If there be delay in planting after receipt of plants, dig a trench and "heel them in," wetting the roots before covering them with earth. Be careful never to expose the roots of the plants to dry air or wind any longer than is absolutely necessary. If the size and plan of your garden will admit of it, set the plants in rows, straight, curved, or serpentine; the rows to be not less than four feet apart, and the plants not closer than three feet in the row. The more vigorous sorts should not be so close. For instance, Magna Charta, John Hopper, Safrano, and several other sorts often grow to cover a space six to eight feet in diameter, and should have room accordingly. Dig holes big enough to receive the roots without bending them. Now take your plant and cut smooth the ends of all broken roots, with a slanting cut, upward and outward, so they may callous and throw their new rootlets downward. Until the rootlets form anew, the plant can make no growth, for the process of transplanting is almost certain to destroy any that may be then in existence, and these alone gather sustenance and feed the plant, and hence are appropriately called "working roots." Consider what portion of the roots must necessarily be destroyed in transplanting, and cut away the top to correspond. It is a law of plant life that there must be a certain correspondence between root and top. If you cut away the top, the root will stop growing until a corresponding amount of top is again restored, and vice versa. Therefore, fully one half the top must be pruned off. Leave from one to three main stems, as taste or the necessities of the case may require, and then trim and cut back till you think you have about the correct proportion between root and top, so they may start off evenly together. In pruning, use a sharp knife, or pruning shears that are likewise sharp. Dull tools do bad work. Old wood, as a rule, should not be cut back; but if disturbed, should be taken clean away.

The plants being prepared, set them in the holes, a little deeper than they grow in the nursery, and draw in sufficient earth to cover the roots, and then pour in water enough to cover the loose earth and settle it about the roots. Then fill the hole full of earth and press it down firmly. Set in this manner, not one in a hundred will fail.

IRRIGATION.

Roses will grow anywhere without irrigation that an orchard will, but they must be thoroughly cultivated to retain the moisture in the soil. If a cultivator be used, go through at least every two weeks; if a hoe, as much oftener as can be conveniently done. But where no water is given they will cease to bloom in July, and rest till after the first rains in autumn, when they will put forth again with great vigor, and unless there be heavy frosts, will continue to bloom all winter, and in fact till July again. Where irrigated, many sorts will bloom without ceasing, but the flowers are not quite so fine as on non-irrigated plants, especially in the autumn.

PRUNING.

If roses are to be grown in the form of trees, of course but one stem will be allowed to grow, and laterals and suckers must be cut away as they push forth from the stem or root, and only such branches be left as will form a symmetrical top. The bush form, however, is most natural, and hence usually produces the best results; and if so grown, it is best to allow two or more stems, cutting away the old and keeping the new and more vigorous as occasion may require. Cutting back will induce new growth of stems and more flowers, but it will dwarf the plants; so, if large plants are desired, spare the knife in this direction, and confine the work to cutting away old and weak wood, only shortening-in such branches as make the plant unshapely. Climbing roses should not be cut back, but such branches as are not wanted should be cut clean away. The only exception to this rule is at the time of planting, when the top should be shortened on account of the loss of the roots. Pruning is best done in the fall, just as the new growth begins.

QUALITY OF PLANTS.

Always get good, strong plants if you can. Those grown from cuttings, without irrigation, are by far the best. One such is worth a dozen hothouse imbeciles, or pot-grown, stunted starvelings; and, if possible, *have them on their own roots.* A few sorts are so difficult to grow from cuttings that it may be necessary to get budded or grafted plants. Again, if you buy standards—that is, those grown in the nursery in tree form—they must have large and vigorous stems. Therefore, as a rule, the stem will be of one sort and the top of another—budded on. These are desirable for a lawn, but for most other places the bush form, as before stated, is far preferable.

Nurserymen sell large numbers of pot-grown roses, for two good and sufficient reasons. Many people will not buy a rose till they see it in bloom, and then they want it right away. The pot plant fills the bill. It shows a bloom, and it can be transplanted at at any time. Such a plant may some time become a good, strong, out-door specimen, but the process is a long and tedious one; whereas, one strong and inured to hardship from the beginning, will at once go down to business, so to speak, and cheerfully respond to any little favors you may give it. The one will find all it can do to live without blossoming, perhaps for a whole season, while the other will show its appreciation of the change by at once covering itself all over with a blaze of glory. Don't blame

the nurseryman. He must please his customers or go out of business. He will prefer to furnish you the best plants if you will have them, and have them at the proper season.

AFTER-TREATMENT.

The treatment of roses after planting consists principally of pruning, cultivating, and mulching. Having already given some hints on pruning, we dismiss that part of the subject. The importance of thorough cultivation has also been referred to. In the fall, mulch your roses with strong manure, covering the ground all over.

Scrapings from the henhouse are best, and a coat half an inch deep of this will be quite as efficient as three times the amount of that from the barnyard, even though it be ever so well rotted. But any kind will answer a good purpose, gauging the quantity by its strength. Coarse litter may be put on four inches deep, and will be found excellent, especially for adobe or heavy soil, making it loose and friable; but for sandy soil it is of little use. In the spring, the mulching should be forked into the ground, or worked in with the cultivator. An occasional treatment with bone meal or other artificial fertilizer is to be commended. In the dry season, liquid manure will be found of great benefit. Leach it from a barrel as ashes are leached for lye, and pour it in a little trench around the bush, filling the trench again with earth when it has soaked into the soil. It should be of the color of weak tea.

If you irrigate, do it thoroughly, but not often. Once in a week or ten days is better than oftener, and if the periods be a fortnight apart it is better still, provided the ground be thoroughly soaked. After irrigating, don't touch the ground again till the surface is dry, and then it must be stirred to prevent baking.

CLASSIFICATION.

Roses may be generally divided into three principal classes, that is to say: Summer roses—those that have but one season of blooming; Hybrid Perpetual, or Remontant roses—those that bloom in the spring, occasionally during the summer, and more or less profusely in the autumn; and Ever-blooming roses—those that bloom continually, unless interrupted by drought or frost.

These general divisions are again usually separated into numerous subdivisions, but the limits of this essay will not admit of their being mentioned in detail. We may say, however, that among the most important divisions of the Summer roses are the Common or Provences, the Prairies, and the Mosses; among the Hybrid Perpetuals are the Hybrid Chinas, Hybrid Bourbons, and Hybrid Noisettes; and among the Ever-bloomers, the Teas, Bengals, Bourbons, Noisettes, Hybrid Teas, and Polyanthas.

There seems much looseness and inconsistency in the classifications on the part of various authors, but we can only allude to the fact here.

As a rule, the strongest growers, most highly scented, and finest finished roses are found among the Hybrid Perpetuals; the most delicate and varied tints among the Teas (so called because of their peculiar fragrance); the finest climbers among the Noisettes, and the most distinct, and perhaps most beautiful, among the Hybrid Teas. It is with

regret that the subject of classification must be dismissed with the little here said.

WHAT SORTS TO PLANT.

The rosarian who has time, pecuniary means, and plenty of room, usually wants nearly every variety that is at all desirable, but the great mass of people are not so situated. They can have but a limited quantity. They should have only the very best. It is hard to select from more than a thousand sorts a set of twenty-five or thirty that are better than any other set of like number. In fact it may be quite impossible, but we can select that number that will be sure to give satisfaction.

Below will be found a list of about double that nnmber, any one of which is excellent, and selections can be made to suit the taste or requirements of the buyer. There are many others equally good, some better for special purposes, but these will answer admirably for a beginning. I give the prevailing color.

HYBRID PERPETUALS, OR REMONTANTS.

Alfred Colomb, scarlety crimson.
Marshall P. Wilder, almost identical with A. Colomb.
General Jacqueminot, deep crimson.
Baronne de Bonstetten, very deep velvety crimson.
Paul Neyron, deep pink.
Magna Charta, deep pink.
Mrs. John Laing, deep pink.
Annie Marie Cote, white.
Coquette des Alpes, white.

TEAS.

Marie Von Houtte, pale yellow, pink-edged petals.
Catherine Mermet, pink.
Madame Lambard, bronze-red.
Madame Welche, cream, with pink center.
Safrano, apricot.
Rubens, light pink.
Baronne de St. Triviers, bronze-red.
Isabella Sprunt, light yellow.
Coquette de Lyon, light yellow.
Madame de Watteville, yellow tinge, with pink-edged petals.
Perle des Jardins, deep yellow.
The Bride, white, sometimes pinked.
Comtesse de la Barthe, pink.
Papa Gontier, brilliant crimson.
La Sylphide, light peach.
Sunset, light apricot.
Edith Gifford, white, with pink center.
Niphetos, pure white.
Comtesse Riza du Parc, bronze-rose.
Bougere, pink.
Souvenir d'un Ami, pink.
Climbing Devoniensis, white, flesh center.
General de Tartas, carmine.
Bon Silene, pink.
Gloire de Dijon, cream, pink, and salmon (climber).

NOISETTES (ALL CLIMBERS).

Maréchal Niel, yellow.
Lamarque, white.
W. A. Richardson, orange.
Gold of Ophir, salmon.
Reve d'Or, apricot.
Celine Forestier, white, with yellow center.

HYBRID TEAS.

Reine Marie Henriette, cherry red (climber).
La France, silvery pink.
Capt. Christy, silvery pink.

Wm. F. Bennett, brilliant crimson.
Puritan, pure white.
Pierre Guillot, deep red.
American Beauty, deep red.
Countess of Pembroke, bronze-red.

BENGALS.

Agrippina, deep blood-red.
Cels Multiflora, blush.
Madame Bosanquet, light flesh.
Archduke Charles, variable, crimson, and white.

BOURBONS.

Souvenir de la Malmaison, flesh.
Climbing Hermosa, pink.

POLYANTHAS.

Cecile Brunner, deep pink.
Perle d'Or, light orange.

MOSSES.

Princess Adelaide, deep pink.
Gracillis, pink, very mossy.

All of the above are good growers here, not excepting Niphetos, which, by the way, is the most beautiful of all white, as Maréchal Niel is of the yellow roses; and most of them are fine, both in bud and open flower, and with few exceptions exceedingly sweet.*

*Horace G. Pratt, in essay before State Floral Society, 1890.

PREPARATION OF THE PRUNE.

When I bought my place, fifteen years ago, or thereabout, I found there an old almond orchard of the Languedoc variety, which never bore well, and never paid me for my work and care. These almonds were all on peach and plum roots, and were quite old trees. Five years ago I budded these almonds with French prunes of the best type I could get, and the buds grew and have made very fine tops. This is the reason the standards are so high. While thus the roots are peach and plum, the intermediate trunks are almonds; the tops are Prune d'Ente, and the very best I have seen anywhere—better than the common d'Agen.

I believe in giving plenty of room, and plant my prune trees twenty-four feet each way, although twenty feet might do. Air and sun are good for prunes, and I give them all they want. As to the proper root for the prune, my old trees are doing so well that I consider peach root a very good root, especially for sandy and well drained soil. For wet and heavy soil, I prefer the Myrobolan plum-root, as this root never rots, and is, besides, a strong and healthy grower. Most of my lately planted trees are on this root. While my old trees are high standards, so that the teams can go underneath without chafing the branches, my younger trees are headed very low. I believe eighteen inches is high enough, and I cut off my trees at that distance from the ground when I plant them.

PRUNING THE TREES.

Every year I cut back heavily, in order to get large and fine fruit. The first year after planting I cut back, leaving only two or three spurs, in order to shape the tree, and on each spur I leave five or six buds—never more. The next or second year after planting, I leave about five or six spurs, each one of them eighteen inches long, which gives to each from ten to twelve buds; and so on, every year increasing the number of spurs until the tree attains its age. Trees treated in this way are goblet shaped, with open crowns, in which air and sun have free access, to the great benefit of both tree and fruit.

The soil is deep, and rich in substance as well as in color, the latter being dark chocolate, retaining its natural moisture received from the rains all through the summer. My orchards are all on rolling lands, one above the other, on the slopes of the Sonoma Mountains; they are as well drained as any place can be, and the trees freely respond to the soil and the care they get.

My prunes bear at four years of age, and I calculate that when six years old they will have paid for themselves. I work the soil well and often, and manure with stable manure at least every second year. The soil should never be allowed to get poor. There are several reasons why the ground should be plowed well. One of them is that when the ground is soft and free from any clods, the ripe prunes will not be bruised when they fall to the ground.

The trees require but little care, if once properly headed and pruned. It is, however, of importance to keep the hot sun away from the trunks, as the latter are apt to sunburn. The rabbits are also bad, and gnaw the bark off from young, unprotected trees. In order to prevent both the former and the latter, I put two stakes close to each tree, and one on each side, respectively. Around these stakes I wrap a strip of burlap, which has been previously soaked in whale-oil soap and sulphur. The burlap keeps both sun and rabbits away, and, as it does not touch the tree, injures it in no way.

RIPENING AND PICKING.

The prunes ripen with me in the middle of August. The first prunes, when fully ripe, fall to the ground by themselves; but a little later on it is necessary to shake the trees. If the ground then is cloddy and hard, the prunes are apt to break, and the juice will run out and spoil the prunes; but when the prunes fall on soft ground, this is not the case. For this reason I spread no canvas or anything else under the trees; the finely pulverized soil is the best for this purpose. When the prunes fall they are only partially dried; and to become perfect and salable, they must now undergo several processes, such as grading, dipping, drying, sweating, and packing. As soon as the prunes are picked, they are taken to the curing house in boxes weighing about forty pounds each.

THE IMPORTANCE OF GRADING.

The first work is now to grade them in several sizes, generally three, but four would be better. There are several reasons for grading before dipping; but the most important one is that prunes of unequal sizes take different lengths of time to dry, and should therefore be exposed in different trays. If the various sizes are placed promiscuously on the same trays, some will dry at one time, others at another time, and we must then either pick out the dried ones by hand, or be contented to have the smaller ones all dried to chips when the larger prunes are ready. It is therefore necessary that they should be assorted as soon as they are picked. There are several different graders in the market which do the work more or less well.

DIPPING.

When the prunes are graded they must be dipped into a caustic solution. The dipping is a most important and essential proceeding, which requires considerable judgment to perform well. The object of the dipping is to give the prunes color, to crack the skin, and to enable the prunes to dry quickly. I put the prunes in wire baskets which will hold about fifty pounds each; but I hardly ever put in more than forty pounds; this is heavy enough to handle. The dipping tank is a double one, made of galvanized iron, and divided into two compartments, one for the lye solution, the other for hot water. Each one of these tanks is thirty inches square, and holds about one hundred gallons of water. In the left hand tank, which I use for the lye solution, a coil runs along the bottom; and the same is connected with a five horse-power boiler, in order to heat the solution without reducing its strength. The adjoining hot water tank is heated by steam directly; and the pipes are so

arranged that the water is continually changing. The lye solution is made from one pound of lye to every twenty gallons of water; but the proper strength cannot always be gauged by the proportion of lye, as some prunes have thicker skins than others, and accordingly require a stronger solution than those with thin skins. The length of time for dipping varies some. Generally it lasts only one or two seconds. Just dip the prunes in and out; and, if the solution is strong and hot enough, the work is done. It is necessary to have the solution boiling hot; and the proper gauge from the appearance of the skin is that the latter must, when taken, be covered with fine cracks, something like the lines in a cobweb.

Immediately take the prunes out and immerse the bucket again into the adjoining tank with the boiling water, in order to rinse off all lye that may adhere to the prunes. Too long immersion in the lye would spoil the flavor of the prunes; and too little rinsing in the pure water would allow the lye to penetrate too deeply into the meat, which also would spoil the quality. As soon as dipped, the prunes are ready to be spread on trays and to be laid out in the sun to dry.

DRYING THE PRUNES.

The most economical trays are long trays made of split shakes, twelve feet long by three feet wide, and held together on three sides by strips of pine one by two inches. The fourth narrow side is left open to allow the prunes to slide out. I have used paper trays, but they are not a success, and caused too much labor. These trays are of the right size for two men to handle, and when full contain eighty pounds of freshly dipped prunes each. The prunes are placed on the trays in one layer only, and must never be heaped one on the top of the other, as they would then not dry evenly. Place the trays directly on the ground. That is by all means the best way. One year I experimented by raising some trays up; but they took a longer time to dry. Properly dipped prunes dry in from four to seven days; but I have had them to dry even in two days. Hot weather is, however, not good for prunes; they dry then too quickly, and do not cure as well as they should. The slow process is much to be preferred. As we have no dew nor fog here during the drying time, it is not necessary to cover over the trays in the night-time. This is the great beauty of our climate.

The prunes are properly dried when shriveled, and when the water in the meat has all evaporated. The meat should look fresh and have a golden color, just as it has in fresh prunes before they are dried at all. They should also be soft and pliable, and should not rattle.

After the prunes are partially dried, we empty two trays into one, so as to save trays; but when trays are plentiful, this is, of course, not needed at all. The emptying of trays may generally be done after two days of exposure to the full sun.

SWEATING.

The prunes should be handled as little as possible. The trays are, therefore, brought directly back to the sweating house (packing or store-room); and there the prunes are simply dumped into the sweating bins. The sweating is done to properly soften and cure the prunes. The sweating bins are large enough to hold four tons of prunes each, and

are of various sizes, so as to suit the space. The best size I have found is five and a half feet high by four feet one way and five feet the other. The bin is made of matched and steamed lumber; and between each bin is a hollow axle in which the air can circulate freely, else the prunes are apt to heat and, of course, spoil. The bins are open at the top, so as to let in air; and the circulation of the latter is promoted by now and then turning over the prunes in each bin. This turning and handling of the prunes is done with wooden shovels, as any other would bruise the prunes. At the lower end of the bin is a sliding door like those in corn bins. By raising it the prunes fall out by themselves. The time for keeping the prunes in the bin is about fifteen days. After that time they are ready to steam and pack.

GRADING AND STEAMING.

After the sweating is over, the prunes must be graded again. Nothing is more important really, and it should be done well. The buyer will only pay according to the smallest fruit in the lot, no matter what size is the majority of the fruit. I remember once I had my fruit graded and ready for sale, and was requested to send a sample of what I had. Instead of sending a sample of different grades, I took a handful from each grade and mixed all up in a bag. The merchant only offered me the price of the very smallest prunes as the price for the whole lot. If they do not do this, no one would care to grade. Large prunes are much better than smaller ones, both as regards flavor and sweetness; it therefore stands good reason why large prunes should be worth more than smaller ones. Hence, the necessity to grade again before packing. But before packing is in order, the prunes must be steamed. For this purpose we have the steaming chest. The steaming is done to give the prunes a fine color, to soften them, and to kill insects and their eggs. I never dip the prunes before packing in glucose, or syrups of any kind. Steaming does away with all this, and produces also a much nicer prune. The prunes should not be shining and glossy, but should have a fine, deep color; and the meat should be golden and transparent and jelly like, not black, spongy, and hard. Prunes prepared according to my method have all these qualities; and, moreover, their kernels, if the stones are cracked, are found full of juice and not dried up. This is also said to be the difference between the imported French and the California prunes. My steaming chest is about five feet by three, and contains ten shelves, with one galvanized iron pan on each. Each pan is furnished with a small pipe, through which the condensed steam runs out, as otherwise, if it should drip from one prune to another, it would discolor the prunes and injure their quality. The time for steaming depends upon circumstances, and cannot always be specified. The prunes must be well heated through, and then immediately packed while yet hot.

PACKING.

Before steaming, but after sweating, the prunes should have been finally graded in at least three grades. First grade is forty-five to fifty prunes per pound; second grade, fifty to sixty per pound; third grade, sixty to seventy per pound. Any smaller prunes than these had better be thrown away, as they would only spoil the other grades. There are

about two hundred pounds of such prunes in every twenty tons. The bulk of the prunes in a good orchard should be the No. 2 grade. Of No. 3 there will always be many more than No. 1. The object of every grower should be to get as many prunes of the highest grade as possible. The packing is simply done. The boxes should contain twenty-five pounds each, as heavier boxes are not liked by the trade. I pack top down; that is, the top is nailed on first, and the prunes packed in, and the bottom nailed on last. First put white paper on the sides, and fold it over the top; then place over this a wax tissue paper, which will not absorb moisture nor get sticky; and then put in the first layer. This should consist of flattened-out prunes, which have been worked flat by hand.*

* Col. Geo. F. Hooper, in "California"—1890.

INDEX.

A

	Page.
ACHEMON SPHINX MOTH—Philampelus achemon	262
ADALIA BIPUNCTATA—Two-spotted ladybird	283
ADDRESS OF WELCOME—Dr. O. H. Conger	42
ADEE, ALVA A.—Instructions to Consulates from	26
AEDEMASIA CONCINNA—Red-humped caterpillar	267
AIKEN, HON. W. H.—Remarks by, on pruning	79
ALMOND CULTURE	72
ALMOND, THE	345
AMBIGUOUS LADYBIRD—H. ambigua	284
AMPELOPHAGA MYRON—Grapevine Sphinx moth	261
ANISOPTERYX AUTUMNATA—Fall Canker-worm moth	268
ANISOPTERYX VERNATA—Spring Canker-worm moth	269
ANNUALS, A PLEA FOR—Essay by Mrs. Ellwood Cooper	124
APHIS LIONS—Lace-winged flies	287
APPLE—Crab	338
New varieties	338
Propagation	338
Scab	247
The	337
Wild crab	339
APRICOT—Plum	238
The	342
ASHY-GRAY LADYBIRD—C. oculata, var. Abdominalis	282
ASIA MINOR—Fig culture in	354
AUSTRALASIA—Fig culture in	363
AUSTRALIAN LADYBIRD—Vedalia cardinalis	282
Winter protection for	468
AZORES—Oranges and lemons in	446

B

BAHIA (BRAZIL)—Oranges and lemons in	403
BANCROFT, A. L.—Essay on "Registration of Plants"	136
BARN MANURE	291
BENEFICIAL INSECTS	279
BERMUDA—Fig culture in	353
BLACKBERRY, THE	343
Wild	344
BLANCHARD, N. W.—Essay on "Lemon Culture"	109
Remarks by, on fruit drying	96
BLOCK, A.—Remarks by	77
Remarks on changing name of prune	92
Resolution introduced by	150
BLOOD-RED LADYBIRD—C. sanguinea	284
BLOWERS, R. B.—Essay on "Table Grapes"	150
BONE MEAL	293
BONES—Composition of	292
Ground	303
Mechanical condition	303
BROAD-NECK BORER—Prionus laticollis	270
BROWN HERMEROBIUS	288
BROWN-NECK LADYBIRD—Scymnus marginicollis	285
BUCK, HON. L. W.—Elected Vice-President	16
Essay on "Eastern Fruit Shipments"	83
Remarks by	77
Remarks on fruit shipments	87

C

CADWELL, O. N.—Remarks by, on the prune	91
CALIFORNIA LADYBIRD—C. transversoguttata	279
CALIFORNIA PRUNE	150
CALIFORNIA (LOWER)—Oranges and lemons in	442

PAGE.
CAMPTON, A. P.—Report by 337
CARR, MRS. JEANNE C.—Essay on "Floral Culture" 122
Vote of thanks to 126
CATABOMBA PYRASTRI—Syrphus fly 287
CATANIA—Fig culture in 370
CHEMICAL FERTILIZATION 290
CHERRY CULTURE 71
CHERRY—The 341
CHESTNUT—The 346
CHILOCORUS BIVULNERUS—Twice-stabbed ladybird 281
CHRYSOBOTHRIS FEMORATA—Flat-head apple borer 272
CHRYSOPA CALIFORNICA—Lace-winged fly 288
CHUBB, DR. O. B.—Remarks by, on orange culture 117
CITRON—Candying 401
Cultivation 401
In Cuba 408
Of commerce 401
Packing and preserving 406
CITRUS FRUITS 97, 104
CLARK, B. O.—Essay on "Ornamental Trees and Shrubs" 139
Remarks by, on forest culture 149
CLYMAN PLUM 239
COAL ASHES 295
COCCINELLA OCULATA—Eyed ladybird 282
Var. Abdominalis—Ashy-gray ladybird 282
COCCINELLA SANGUINEA—Blood-red ladybird 284
COCCINELLA TRANSVERSOGUTTATA—California ladybird 279
COCCINELLA TRIFASCIATA—Julian's ladybird 285
COLLINS, W. E.—Elected Chairman of meeting 28
Essay on insect pests 47
COMMERCIAL FERTILIZERS 296
Most profitable use of 305
COMMITTEE, EXECUTIVE—Report of 18
COMMITTEES—Reports from 168
CONGER, DR. O. H—Address of welcome 42
Elected Vice-President 16
Remarks by 77
Remarks by, on the lemon 111
Vote of thanks to 46
CONGRESS, MEMORIALS TO 15, 26, 182
On "Tariff on Fruits" 180
CONOTRACHELUS NENUPHAR—Plum curculio 278
CONVENTION—Fruit Growers Thirteenth 36
CONVERGENT LADYBIRD—H. convergens 284
COOPER, HON. ELLWOOD—Called Convention to order 36
Opening address 37
Remarks by, on pruning 75
Resolutions, thanking 182
COOPER, MRS. ELLWOOD—Essay "A Plea for Annuals" 124
Vote of thanks to 126
CORRESPONDENCE 25
CORSICA—Fig culture in 368
COTTON SEED—Value of, as a fertilizer 299
COTTONY CUSHION SCALE—Rise and downfall 58
CRAW, ALEXANDER—Essay on "Predaceous Insects" 52
Report by 347
CROCKER, H. S. & CO.—Lithographs by 25
CRYSTALLIZATION OF FRUIT 384
CUBA—Fig culture in 354
CULTIVATING 67
CURRANT, THE 342
CURRANT SPAN-WORM—Eufitchia ribearia 266
CURRANT WORM—Nemantus ribesii 264

D

DARDANELLES—Fig culture in 380
DATE PALM—In Persia 400
DEILEPHIA LINEATA—White-lined Sphinx moth 260
DEMING, THEO.—Remarks by, on pruning 82
DIABROTICA SOROR—Spotted diabrotica 275
TRIVITTATA—Three-striped squash beetle 275
DILLON, H. C.—Remarks by, on insect pests 62
DORMAN, A.—Essay on "Walnut Culture" 161

E

PAGE.
EISEN, GUSTAV—Essay on "Pruning the Muscat Grape" 152
EMPEROR MOTH—Platysamia cecropia 254
ENTOMOLOGICAL 250
ENTOMOSPHORIUM MACULATUM 244
EUFITCHIA RIBEARIA—Currant span-worm 266
EUSCHISTUS TRISTIGMUS—Gray soldier bug 286
EXECUTIVE COMMITTEE 15
Report of 18
EXOCHOMUS PILATEI—Pilate's ladybird 281
EYED LADYBIRD—C. oculata 282

F

FALL CANKER-WORM—Anisopteryx autumnata 268
FERTILIZATION 290
FERTILIZERS—Application of 301
Commercial 296
Manufacture of 300
Notes on 349
FIG—The 343
FIJI—Fig culture in 364
FLAT-HEAD APPLE BORER 272
FLORAL CULTURE 122
FORD, GEO. W.—Essay on "Walnut Culture" 158
FOREIGN COUNTRIES—Fruit culture in 353
FOREIGN WALNUTS 162
FOREST CULTURE 141
Discussion on 149
FRANCE—Crystallization of fruit 384
Fig culture in 365
Olive culture in 460
FRANCE (SOUTHERN)—Fig culture in 369
FRUIT CULTURE IN FOREIGN COUNTRIES 353
FRUIT DRYING 82, 85
Discussion on 87, 93
FRUIT SHIPMENTS 82
FRUITS—Candied 393
Carameled 395
Crystallized 394
Iced 392
Process of crystallizing 399
Sugars for 393
Tariff on 178
FUMIGATING APPARATUS—Improved 469
FUMIGATION 351
FUNGI 242
Entomosphorium maculatum 244
Fusicladium dentriticum 247
Septonia cerasina 243
FUNGOUS GROWTHS 242
FUSICLADIUM DENTRITICUM 247

G

GAREY, THOS. A.—Essay on "Citrus Fruits" 104
GENOA—Oranges and lemons in 419
GILLET, FELIX—Essay on "Walnut Culture" 162
GLADDEN, W. N.—Essay on "Fruit Drying" 85
GRAPE, TABLE 150
GRAPEVINE FLEA BEETLE—Haltica chalybea 274
GRAPEVINE SPHINX MOTH—Ampelophaga myron 261
GRAY SOLDIER BUG—Euschistus tristigmus 286

H

HALTICA CHALYBEA—Grapevine flea beetle 274
HAMILTON, HIRAM—Essay on "Red Scale" 58
HAZARD, MAYOR H. T.—Remarks by 42
Vote of thanks to 46
HAZELNUT, THE 346
HERMEROBIUS—Unnamed 288
HIPPODAMIA AMBIGUA—Ambiguous ladybird 284
CONVERGENS—Convergent ladybird 284

PAGE.
HOBART, J.—Remarks by, on the walnut 166
HOLT, L. M.—Remarks by, on pruning 79
HORTICULTURAL COMMISSIONERS—County Boards of 26
Meetings of 28
HUCKLEBERRY, THE 345
HUMBOLDT COUNTY—Fruit culture in 337
HUMUS 290

I

ICED FRUITS 392
IMPROVED FUMIGATING APPARATUS 469
INSECT PESTS AND LAWS THEREFOR 47
Discussion on 61
INSECTS—Apparatus for collecting 251
Beneficial 250
Injurious 250
Studying 254
ITALY—Citron culture in 401
Fig culture in 370
Olive culture in 448

J

JORGENSEN, CHRIS—Sketching by 25
JULIAN'S LADYBIRD—C. trifasciata 285

K

KELLOM, J. H.—Remarks by, on pruning 78
Remarks by, on insect pests 68
KEOBELE, ALBERT—Resolutions thanking 61
KERCHEVAL, A. F.—Essay on "Tariff on Fruits" 178
KINNEY, HON. ABBOT—Essay on "Forest Culture" 141
Remarks by, on "Orange Culture" 117
Resolution by 61

L

LACE-WINGED FLY—Chrysopa Californica 288
LACHNOSTERNA FUSCA—May beetle 272
LANKERSHIM, J. B.—Elected Vice-President 36
LAWS RELATING TO HORTICULTURE 7–11
LEGISLATION 181
Committee on 66
LELONG, B. M.—Called Convention to order 28
Remarks by, on the orange 119
Remarks by, on the Vedalia 61
Report as Secretary 15–22
Supplement to report 183
LEMON CULTURE 107
Treatment of 109
LEMON, THE 409
In France 409
In Genoa 419
In Palermo 425
In Sicily 432
LEMONS—Picking and curing 430
Varieties in France 417
LIBRARY—Books in 29
LOOP, C. F.—Essay on "Olive Culture" 97
Vote of thanks to 104

M

MACROSILA CAROLINA—Tomato hawk moth 257
MADEIRA—Citron culture in 408
MALAGA—Fig culture in 377
MANURE—Composition of 291
Fetilizing properties of 291
MARSEILLES—Crystallization of fruits in 384
MAY BEETLE—Lachnosterna fusca 272
McCOPPIN, HON. FRANK—Resolution thanking 61
McDONALD, COL. MARK L.—Remarks by 76

PAGE.
MECHANICAL BARRIERS ... 276
MEETINGS—Horticultural Commissioners ... 28
State Board ... 15
MEGILLA VITTIGERA—Striped ladybird ... 286
MEMORIALS TO CONGRESS ... 15, 26, 182
MESSINA—Citron culture in ... 404
Fig culture in ... 371
Oranges and lemons in ... 421
MEXICO—Citron culture in ... 408
Fig culture in ... 381
Oranges in ... 439
MILES, FRED. C.—Appointed Commissioner ... 16
Vote of thanks to ... 182
MOROCCO—Fig culture in ... 382
MOSHER, J. L.—Essay on "Fruit Drying" ... 82
MULBERRY, THE ... 345
MUSCAT GRAPE—Overbearing ... 154
Pruning ... 152

N

NAPLES—Cultivation of citron in ... 406
Fig culture in ... 373
NATIONAL REGISTRATION OF PLANTS ... 136
NECTARINE, THE ... 342
NEMANTUS RIBESII—Currant worm ... 264
NITRATE OF SODA ... 301
NITROGEN ... 304
Manuring with ... 327
Sources of ... 299
NUTS—Walnuts and almonds ... 345

O

OLIVE CULTURE ... 97
In France ... 460
In Italy ... 448
OLIVE—History of introduction ... 185
Oil manufacture ... 190
Mission ... 185
OLIVE OIL—Clarification ... 226
Collecting ... 221
Diseases of ... 231
Filters ... 206
Implements used in manufacture of ... 196
Mode of collecting the grounds ... 222
Preservation of ... 229
Preservation of the olive for ... 208
Vats ... 206
Vessels for preserving ... 207
OPUNTIA FRUIT ... 133
Cultivation ... 134
Gathering ... 135
Removing the skins ... 135
Removing the spines ... 134
ORANGE, THE—In France ... 409
In Genoa ... 419
In Palermo ... 425
In Sicily ... 432
Picking and curing ... 430
Propagation and planting ... 437
Varieties in France ... 417
ORCUTT, C. R.—Essay on "Ornamental Wild Flowers" ... 126
ORNAMENTAL TREES AND SHRUBS ... 130

P

PAPILIO RUTULUS—Swallow-tail butterfly ... 262
PARASITES AND PREDACEOUS INSECTS ... 39
PALERMO—Fig culture in ... 374
Oranges and lemons in ... 425
PALM, THE DATE ... 400
PEACH, THE ... 341
Early Imperial ... 241

	Page.
PEANUT, THE	345
PEAR CRACKING AND LEAF BLIGHT	244
PEAR, THE	339
PECK, REV. N. R.—Resignation of, as Commissioner	16
PELIDNOTA PUNCTATA—Spotted Pelidnota	273
PERSIA—Date palm in	400
PERSIMMON, THE	342
PHILAMPELUS ACHEMON—Achemon sphinx moth	262
PHILAMPELUS PANDORUS—Sphinx moth	258
PHOSPHORIC ACID	291, 304
Manuring	319
Sources of	297
PIERCE, HON. N. B.—Essay on "The Vine Disease"	169
Vote of thanks to	177
PILATE'S LADYBIRD—Exochomus Pilatei	281
PLANTING	67
PLANTS—Composition of	297
National registration of	136
PLATYSAMIA CECROPIA—Emperor moth	254
PLUM CURCULIO—C. nenuphar	278
PLUM, THE	339
Clyman	239
Propagation	340
PLUMS AND PRUNES	233
PORTUGAL—Fig culture in	377
Oranges and lemons in	446
POTASH	290
Sources of	299
POTASH SALTS—Manuring with	325
PREDACEOUS INSECTS	52
PREPARING FRUIT	390
PRIONUS LATICOLLIS—Broad-neck borer	270
PRUNE, THE	233
d'Ente	233
Nomenclature of	233
Tragedy	233
PRUNING	67
Objects of	70
PRUNUS SIMONI	238
PSYLLOBORA 20-MACULATA—Spotted psyllobora	284
PUBLICATIONS	15, 25

Q

QUARANTINE GUARDIANS	15, 29
QUARANTINE REGULATIONS	12
QUINCE, THE	339

R

RASPBERRY, THE	344
RED-HUMPED CATERPILLAR—Ædemasia concinna	267
RED SCALE	58
REGULATIONS, QUARANTINE	12
REPORT—Secretary	15
Treasurer	16
RESOLUTIONS—Adopted	182
RICE, GEO.—Essay on "Cottony Cushion Scale"	53
ROBE DE SERGENT (SYN.)	235
ROGERS, E. A.—Essay on "Woolly Aphis"	58
Remarks by, on fruit drying	93

S

SALMON BERRY, THE	345
SANTA CRUZ—The next place of meeting	181
SAPERDA CANDIDA—Two-striped borer	271
SCYMNUS MARGINICOLLIS—Brown-neck ladybird	285
SECRETARY—Reports of	15, 22
SEPTONIA CERASINA—Shot-hole fungus	243
SHOT-HOLE FUNGUS	243
SHRUBS WORTHY OF CULTIVATION	126
SICILY	432
Fig culture in	375
Oranges and lemons in	432

PAGE.
SINEA SPINIPES—Spine-legged soldier bug 286
SMALL FRUITS—Culture of 156
SMITH, D. EDSON—Essay on small fruits 156
SMITH, T. E.—Remarks by, on fumigating 64
SNOW, PROF. T. N.—Remarks by, on insect pests 62
SOFT-SHELL WALNUT 158
SOILS—Deterioration of 296
Formation and composition of 296
SOUR ORANGE STOCK 351
SOUTH AMERICA—Oranges and lemons in 443
SPAIN—Fruit culture in 377
Oranges and lemons in 445
SPECIAL REPORTS 337
SPHINX MOTH—Philampelus pandorus 258
SPILOSOMA VIRGINICA—Yellow bear moth 263
SPINE-LEGGED SOLDIER BUG—Sinea spinipes 286
SPOTTED DIABROTICA—D. Soror 275
SPOTTED PELIDNOTA—Pelidnota punctata 273
SPOTTED PSYLLOBORA—Psyllobora 20-maculata 284
SPRING CANKER-WORM—Anisopteryx vernata 269
STABLER, H. P.—Elected Secretary horticultural meeting 28
STATE BOARD OF HORTICULTURE—Meeting 15
STILES, HARVEY C.—Essay on "Lemon Culture" 107
STRAWBERRY, THE 343
STRIPED LADYBIRD—Megilla vittigera 286
SUGARING FRUIT 390
SUPERPHOSPHATE—Manufacture of 298
SUPPLEMENTARY REPORT—B. M. Lelong 183
SWALLOW-TAIL BUTTERFLY—Papilio rutulus 262
SYRIA—Fig culture in 357
SYRPHUS FLY—Catabomba pyrastri 287

T

TABLE GRAPES 150
Varieties of 151
TARIFF ON FRUITS 178
Discussion on 180
Resolutions adopted 180
THOMAS, I. H.—Remarks by, on fruit pests 65
THOMPSON, C. C.—Remarks by, on pruning 81
THORPE, S. R.—Remarks by, on fruit drying 93
THREE-LINED SQUASH BEETLE—D. trivittata 275
TOMATO HAWK MOTH—Macrosila carolina 257
TOMPKINS, GILBERT—Essay on "Cherry Culture" 71
TRAGEDY PRUNE 233
TRANSPLANTING 67
TREASURER—Report of 16
TREAT, WEBSTER—Essay on "Almond Culture" 72
TREES—Ornamental 139
TURKEY—Fig culture in 377
TWICE-STABBED LADYBIRD—C. bivulnerus 281
TWO-SPOTTED LADYBIRD—Adalia bipunctata 283
TWO-STRIPED APPLE BORER—Saperda candida 271

V

VALLEJO, GEN. M. G.—Death of 16
Resolutions of respect to 20
VARNUM, G. W.—Essay on "Transplanting and Pruning" 67
VEDALIA CARDINALIS—Australian ladybird 282
Winter protection for 468
VENEZUELA—Fig culture in 353
VICE-PRESIDENTS—Election of 36
Appointment of 16
VINE DISEASE, MYSTERIOUS 169
Resolutions with regard to 177

W

WALNUT CULTURE 158, 161, 162
WALNUT, THE 345
Discussion on 166
WATERMAN, GOVERNOR R. W.—Remarks by 41
Vote of thanks to 46